A Dissertation on

"A COMPREHENSIVE STUDY OF DEATH DUE TO BURNS IN MARRIED WOMEN, AMONG THE AUTOPSIES CONDUCTED AT GOVERNMENT KILPAUK MEDICAL COLLEGE & HOSPITAL, CHENNAI"

Submitted to

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

In partial fulfillment of the requirements

For the award of degree of

M.D. (FORENSIC MEDICINE)

(Branch-XIV)

GOVERNMENT KILPAUK MEDICAL COLLEGE & HOSPITAL
THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY,
CHENNAI, TAMILNADU.
APRIL 2016

CERTIFICATE

This is to certify that this dissertation titled **"A COMPREHENSIVE STUDY OF DEATH DUE TO BURNS IN MARRIED WOMEN, AMONG THE AUTOPSIES CONDUCTED AT GOVERNMENT KILPAUK MEDICAL COLLEGE & HOSPITAL, CHENNAI"** submitted by **Dr. SHANKAR.S** to the faculty of FORENSIC MEDICINE, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, towards partial fulfillment of the requirements in the award of degree of M.D. (FORENSIC MEDICINE) Branch -XIV for the April 2016 examination is a bona-fide research work carried out by him during the period of September 2014 to August 2015 at Government Kilpauk Medical College & Hospital, Chennai, under our direct supervision and guidance of **Dr. R. SELVAKUMAR M.D.,** Professor and Head of the department, Department of Forensic Medicine at Govt. Kilpauk Medical College, Chennai.

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DECLARATION

I, **Dr. SHANKAR. S** solemnly declare that the dissertation on **"A COMPREHENSIVE STUDY OF DEATH DUE TO BURNS IN MARRIED WOMEN, AMONG THE AUTOPSIES CONDUCTED AT GOVERNMENT KILPAUK MEDICAL COLLEGE & HOSPITAL, CHENNAI"** is a bona- fide work done by me during the period of September 2014 to August 2015 at Government Kilpauk Medical College and Hospital, under the expert Supervision of **Dr. R. SELVAKUMAR, M.D,** Professor and Head of Department of Forensic Medicine, Government Kilpauk Medical College, Chennai. This thesis is submitted to The Tamil Nadu Dr .M.G.R. Medical University towards partial fulfillment of the rules and regulations for the M.D. degree examinations in Forensic Medicine to be held in April 2016.

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ABSTRACT

Aim:

The present study was taken up to know the pattern of deaths due to burns in married women and to analyze the probable reasons for the same and analyse the socio etiological factors involved and to suggest preventive measures.

Objectives:

To identify the most common cause of burns, to know the distribution of burn injuries according to their degree and total body surface area affecting these persons and to identify the risk group.

Methodology:

The present work will include study of burns cases received for autopsy in the Department of Forensic Medicine & Toxicology, Govt. Kilpauk Medical College and Hospital between September 2014 and August 2015.

Results:

Out of the total 2953 number of post mortem conducted between 1-9-2014 to 30-8-2015, 80 cases of deaths due to burns in married woman were taken up for study. Maximum number of death 53.75% occurred in the age

group 21-30 years. Majority of them belongs to Hindu religion (83.75%), Most of them were house wives (92.5%). Maximum cases belongs to the category of marital age > 7 years (67.5 %) and majority of the victims belongs to lower socio economic status (93.75%). Most of the cases were found to be from rural area (58.75%). Regarding the educational status, maximum cases belongs to high school education (32.5%) followed by primary school education (31.25%). Majority of the incidence occur at home (93.75%) and at winter season (46.25%). Most of the deaths were suicidal in nature i.e.55%, followed by accidental burns (42.5%) and the minimum number of cases were of homicidal burns (2.5%).Peak incidence of burns occurrence between 04P.M to 10 P.M (35%).All the incidence occur by flame and majority them were due to pouring of kerosene oil (56.25%). Majority of victims (37.5%) died with more than 80% burns and 28.75% victims could not survive for more than 12 hours. Presence of soot particles in airways observed in 18.75% cases and cloudy degeneration of kidney in 85%cases. Most of the victim (42.5%) died due to neurogenic shock.

Keywords: Married woman, pattern of burns and manner of death.

INTRODUCTION

Burn injuries and their sequel pose a public health problem. Every year, it was found that burns caused by fire were responsible for about 265,000 deaths globally. More than 90% of fatal fire-related burns occur in developing or lower and middle income countries (LMICs). Out of this, South- East Asia alone accounts for more than half of these fire-related deaths. In South East Asian region, death due to Burns in girl / women is more than that of Tuberculosis, HIV/AIDS and malaria combined.

In India, burn injury is found to be one of the major cause of death, especially in females. The problem of death due to burns in developing countries like India is primarily due to various socio-cultural factors prevalent in the country. Some of these factors includes poor housing conditions, poor maintenance of electrical appliances, customs of wearing dresses like sarees or dupatta, practice of dowry, illiteracy level and poverty. The precise numbers of burns incidence is very much difficult to arrive due to large population and lack of incident reporting. The loads of over-population, illiteracy, low socio-economic status, poor standards of safety at home and at work place, corruption etc has caused a significant rise in burns cases.

Death due to burns among married women, reflects the prevailing social setup and mental health status of a region. A swift increase in unnatural deaths especially in the initial period of married life was observed in our society in last few years which is a dark spot on the upright tradition of our society.

Reproductive age group is said to be 15-44 years and is an important crucial period and a marker for human development and any imbalance can affect the health of next generation, social and economic development and thereby the society. Status of girls and women in society and how they are treated is a crucial determinant.

Indian women have high mortality rate particularly in childhood and reproductive age, the causes of which are usually natural. Unnatural causes like accidents and suicides also contribute substantially to the mortality load among these women in recent times.

Fire has been known to mankind for about 400,000 years. Most of the communities believe that the whole universe is made up of five essential elements. Water (jal), Air (Vayu), Earth (Prithvi), Sky (Aakash) and Fire (Agni). So, this way fire or burns have great importance in our life

The use of fire in various aspects has not only added to our comforts but also added to our misuses by increasing the risk of burns. Fire can be considered as man's first double-edged sword, evidenced throughout history; it has served as well as destroyed mankind **1**.Burn injuries are dry thermal injury caused due to contact with

raw heat such as flame, radiant heat or some heated solid substance like metal or glass, to the body surface **2**. Mammalian tissue can survive only within a relatively within narrow range of temperature, 22-44^0 C **3**.Thus burning usually occurs due to contact with flame it may be caused due to contact with hot metal or any other hot solid or hot liquid. The severity of burning very extremely depending on the degree of heat, period of exposure, intensity of heat and age of the person. Burn deaths have remarkable medico-legal significance as it can be considered as most common cause of unnatural deaths in our country. Often, the manner of burns is closed in mystery, and unreliable statements. The reason behind this action may be domestic, personal, occupational or social tragedy and more recently dowry deaths. Burns in married female where death of female occurs below 30 year and within seven years of her marriage such death cases investigated by Magistrate under Cr.P.C 176 (Dowry death) and other female burn and male burn deaths as routinely investigated by police as per section 174 of Cr.P.C. In India below 7 year married female burn deaths are linked with Dowry death, where a young married women attempt or commits suicide in consequent to their being subjected to harassment by their husband or in-laws or his relative or cruelty constitute the offence of Dowry death, a monstrous social evil is widely prevailing and deep rooted in society in spite of most of the awareness programmers but this is due to adequate legal system but her implementation and administration are not stringent

Burns constitute a major role in mortality and morbidity in the whole world, whether accidental, suicidal or homicidal. Burn injuries are one of the most disturbing of all injuries and considered as a major global public health issue. It was found that burns are the fourth common type of suffering worldwide, following interpersonal violence, traffic accidents and falls.

A burning topic in India is the burn deaths of young females. Such a way of ending life is peculiarly common in our country. Many newly married females who are young die from injuries caused by burns. The most common explanation given in postmortem inquest reports therefore being that the person caught a spark (a) while doing cooking, (b) after an oil burst in a stove or (c) when a lamp fell on the person at night. The enquiry performed with relatives or neighbors generally reveals the above explanations are not true.

The aims and objective of this research work is to study the epidemiology of burns in married women in this region of the country and find out certain reasons and causes particular to our social setup with special emphasis on preventive aspects of burns in married women.

AIM AND OBJECTIVES:

1. To perform a study on the pattern of unnatural deaths (burns) in married women and to analyze the probable reasons for the same.

2. To analyze the socio etiological factors involved and suggest preventive measures.

3. To know the distribution of burn injuries according to their severity and total body surface area affecting these persons and period of survival with Histo-Pathological changes in Kidneys.

4. To identify the risk group.

REVIEW OF LITERATURE:

Legal aspects of Burns[1,2]

Culpable Homicide: Is causing death by performing an action…

(1) With the intention of bringing death or

(2) With the intention of bringing injury to body which could cause potential death.

(3) With the knowledge that such act is most likely to bring death to a person (**SEC 299 IPC)**.

Murder: Culpable homicide is Murder…

(1) act done by which a person's death is caused with the purpose of bringing on death, or

(2) act done with the intention of causing such injury to body as the offender knows the injury could likely cause death, or

(3) done with the aim of causing such injury to body which is adequate in the general course of nature to cause a death, or

(4) If the person performing the act knows that it is immediately dangerous, that it must in all likelihood cause death, or injury to body as likely to cause death and performs such act without any excuse (**SEC 300 IPC**).

Culpable homicide does not amount to murder: If the action by which death is caused is performed…

(1) Under severe and impulsive provocation

(2) In good trust of the right of private defence of person or property **SEC 96 – 106 IPC**

(3) For the advancement of public justice

(4) with-out premeditation and

(5) When the person aged more than 18 years inflicts death with his own consensus.

Punishment of Murder by Burning:

Death or imprisonment for life with fine **SEC 302 IPC.**

Punishment due to culpable homicide not amounting to Murder:

Life Imprisonment or imprisonment for a specific term which may be up to 10 years with fine **SEC 304 IPC.**

Nature of Burns in the absence of death:

In case when death has not occurred, Burns will constitute simple or grievous hurt. Burns of First degree – not resulting in scar are considered as simple, other degrees or severe burns will constitute grievous hurt **SEC 320 IPC**, and punishment is awarded according to **SEC 324 , 325 and 326 IPC**.

Legal Aspects of Dowry Death

Contributing to this view, and to make more effective the Dowry Prohibition Act, 1961 the late Prime Minister Shri Pandit Jawaharlal Nehru said dealing with this evil:

"Legislation cannot be itself normally solve deep-rooted, social problems. One has to approach them in other ways too, but legislation is necessary and essential so that education factor, as well as the legal sanctions behind it which help public opinion is to be given a certain shape"

The above Act was amended in 1983 to include a provision for the punishment for cruelty to married woman, which was aimed at dealing with problem of dowry deaths.

Section 304B IPC – Dowry Death

Under this section, the death of a woman due to

a) any burns, or injury to body happens under normal circumstances within seven (7) years of a woman's marriage, or

b) Women's age was less than 30 years at the time of her death and it is proved that soon before women's death she underwent harassment or cruelty by her husband or any relative of women's husband for, or in connection with any demand for dowry.

In above such cases, death shall be called “Dowry Death” and such husband or relative shall be deemed to have caused her death. The punishment is made deterrent by providing minimum punishment of seven years imprisonment.

History of Burns [3-8, 25]

Among all the discoveries made by man, fire was born due to eventful development in the nature. It can be assumed that in the earlier days, man encountering fire was generated by natural events – falling meteors, lightening, from volcanoes, etc. Probably it took many thousands of years for man to learn, to admire fire of his own making, and almost every country have their own version of how the fire was discovered.

- As per North American history, it was the ‘Buffalo’ that gave fire to man, as they raced across the plains at night the sparks from their hoofs hitting the rocks.

- As per the Indian history, the cave man accidentally discovered fire and used it for day-to-day living. He realized that two pieces of hard stones when rubbed together produced sparks. If the sparks fall on dried leaves, they burst into flames. As per history, early man witnessed wild creatures

running away from the forest fires, so he used fire to protect himself from many wild animals. Discovery of fire also changed the eating habits of early man. Man found the roasted meat tastier. This was also the start of cooked food.

It took for ancient man a long, long time to understand, appreciate, and reproduce their natural occurrences, but it took him to time at all to realize that a fire can 'hurt and badly hurt'.

Man know about injuries caused by burns since the time he discovered fire. Because of the myriad uses that fire can be put to, and also because of the great havoc and devastation that it can cause, ancient man began to worship it as a deity. From our Puranas, we know that fire had been used as a method of committing suicide as well as a mode of sacrifice. Women used to consume their bodies to flame, when their warrior husbands were vanquished in the battlefield, to avoid humiliation at the hands of the enemy invaders. A gory practice that used to be practiced by women in the middle ages was "Sati", wherein a widow would burn herself into the funeral pyre of her husband. This continued, till Raja Ram Mohan Roy put his foot down and stamped out the barbaric ritual. In recent times, accidents due to fire have escalated to an alarming extent. One of the greatest fire disasters to occur in contemporary times was the coconut grove fire in Boston, in 1942.

In warfare, injury from incendiary attacks from the air with conventional weapons has produced devastation. At Hamburg in 1943, hundreds of tones of incendiary bombs caused a firestorm destroying 60% of the city and killing at least 65000 persons. A second firestorm destroyed Dresden, in February 1945, engulfing 21 Km of the center of the city in flame and causing an estimated mortality of 135000. The atomic attack on Hiroshima destroyed a city and 80000 people. Death as caused by the terrific heat at the center of the explosion and the secondary fires started over a wide area of the total injured in the 1963 Yom Kippur war, 10% were burn casualties.

Napalm has been developed as a particularly effective weapon against military personals. It is modified by mixing with additivesm which changes its flow properties. It is thus cohesive but also adhesive, sticking to surface as burning gobbets. Napalm (a name derived from Aluminium naphthalene and palmitate) is now a generic term for all types of thickened hydrocarbons used as incendiary hydrocarbons. White phosphorous or magnesium are usually added to ignite these oil-based incendiaries. As weapons, they produce very high temperature on burning, well in excess of 1000ºC and, since they are adhesive, targets ignite easily. The effect on individuals is devastating. The full thickness burns are usually extensive (over 25 per cent of the body surface), the phosphorus present causes toxic injury and the adhesive properties make the material impossible to remove. The inhalation of hot gases may cause asphyxia from obstruction of the air-passages and destruction of the alveoli.

Phosphorous burns as encountered on the battle field or in industry, may cause death even if only 12-15 per cent of the body surface is involved. Burning phosphorous causes a lesion, which progresses until either all the phosphorous is used up or the area of the lesion fully deprived of oxygen.

Apart from the actual burn, there is primary renal damage from specific toxic injury, with glomerular and tubular necrosis, causing early death from renal failure.

Fabricious Hildanius in Switzerland gave the first printed extensive description of burns, their classification and their treatment in his book Decombustionibus in 1607.

Burn trauma is as old as the discovery of fire in the history of mankind:

1. The trial starts with Hippocrates about 430 BC. He offered variety of preparations for treatment of burn injury like, warm vinegar, oak bark solution, etc.
2. Guilhelmus Fabricuius Hildanus (1607), the father of German Surgery brought forth the first attempt at classification of burns into 3-degrees.
3. Heister (1638-1758) classified burns into four degrees.
4. Dupuytren (1832) classified burns into six grades /degrees, according to depth of injury caused.

5. Curling (1842) recognized gastric and duodenal ulceration as a problem of severe burn injuries. It was manifested by reduced water content, increased hemoglobin and decreased blood volume. The need for IV fluid replacement therapy was pointed out by Jappeiner and further by Parascandolo (1901).
6. Underhill's (1877-1931) enlightening studies showed that shock in burn is due to fluid loss and not due to toxin. Baradue in 1863 maintained that, in burn the decrease of the circulating volume of blood was the most likely cause of death and that viscosity of the blood was increased.

7. Cope and More (1942) established that the fluid loss was happening inside the patient and not exclusively outside, which provided an explanation for the hidden fluid loss in burns. Many patients died of so-called burn shock due to inadequate fluid therapy.

In 1954, septicemia was first emphasized as a common cause of death in burns by Leiberg, Reiss and Artz. Before this it was believed that most patients died from burn shock of burn toxin.

The classic work of Tephtz and Moncrief in 1964 characterized the pathogenesis of invasive burn wound infection.

In 1924, Berkow provided data as a percentage, by surface area of various parts in the body. Lend and Browder found the changes in percentage of body surface area of various parts that happen during different stages of development from birth through childhood and devised a special chart.

The "rule of nine" first devised by Tennison and Pulaski divides body surface area into multiples of nine percent, popularly, known as 'rule of nine'.

Causes and Prevention of Burns:

Causes of Burns:

The major causes of burns are open flames, scalds, direct heat and burns of unknown origin. Burns from industrial accidents result primarily from molten metals. Flammable volatile liquids and high voltage electricity are also important causes.

Most severe burns tend to occur during the colder months and seventy five percent of incidents occur in homes. A major contribution to home fires is faulty building constructions with overcrowded and substandard conditions. Stoves and heaters with burning wood, oil, charcoal or gas are also primary contributors.

Forty percent of the accidents are due to kerosene stoves, kerosene lamps, pressure cookers and bursting of gas cylinders. Rodents also constitute a major cause

of accidental burns, as they cause damage to the rubber tube, which conveys the leakage of gas from the cylinder to the stove.

Children in the age group of 1-3 years while exploring environment may injure themselves from fire and boiling liquids. In children under three years of age, most burns are due to scalds. In those from 3-14 years burns are due to clothing catching fire commonly. In persons ranging from 15-60 years industrial accidents account for a large number of burns. In those over 60 years of age burn accidents associated with momentary blackouts, smoking in beds or houses on fire are the most common causes. Home accidents are fifteen times more common than burns in the industry.

Epileptics are prone to the risk. Burns arise as a result of falling into fire during a fits and involve any part of the body as there is no attempt to escape from the flames due to loss of consciousness. In the Indian custom the wearing of sari is being blamed for catching fire accidentally.

A clothed body catches fire more swiftly than an uncovered one, and the body of a fat individual is used up more thoroughly than that of a lean person. The heat of fire often exposes the body fat and the clothing may act as a wick, providing for favorable conditions for complete combustion.

Highly inflammable plastics and synthetic polymers are increasingly in use in homes and these are widely used as foams for upholstery mattresses and backing of carpets. A blaze may spread in the surroundings when these materials are involved.

Migration of thousands of families from the country side to the cities and the fundamental change in their environment increases the risk of burns from unfamiliar cooking ranges and appliances for which proper instructions are not followed or they cannot read the instructions due to illiteracy.

Prevention of Burns

At least half of all the burning accidents could be prevented, as burns remain primarily accidents of the home or common domestic hazard which are caused by carelessness and ignorance, and would not have occurred if caution and safety measures would have been undertaken.

Clothing is usually involved in fatal case of burns. The labeling of the garments as to the flammability of the fabric for taking precautions and the use of non-flammable textiles may decrease the incidence of deaths due to burns.

Containers of flammable contents should be labeled properly and the gasoline, kerosene and other volatile liquids should be stocked in safe places, out of reach of children and away from the sources of heat. As a safety precaution these fluids should not be used indoors.

The National Fire Protection Associations of some countries state that a carelessly discarded cigarette when left in places like un-cleaned rubbish and in inflammable circumstances becomes a breeding place for fire and can cause havoc. Fire death occur when simple safety rules are violated like smoking in bed, leaving

children alone, neglecting to teach youngsters that matches and lighters are not play things.

ANATOMY AND PHYSIOLOGY OF SKIN[9,10]

The thickness of the skin differs with the anatomic area of the body and also based on the age of the individual. Skin thickness is generally less in infancy, children and elderly .Skin is the thickest on the scalp, the palms and the sole of the feet. It is thinnest on the eyelids, genitals, anterior neck, flexor surface of arms and forearms and on the antecubital, popliteal and interdigital spaces.

Skin composed of **2 layers** namely **epidermis and dermis**.

EPIDERMIS:

It is the protective superficial layer of skin. It comprises of stratified squamous epithelium which can vary in thickness between 0.007 and 0.12mm.

The **epidermis** is divided into **five microscopic layers**.

-**Stratum Corneum**: It consists of 25 to 30 layers of flattened scale like cornified, hard, non-nucleated horny cells containing keratin. This layer is subjected to constant shedding.

-**Stratum Lucidum**: Lies immediately adjacent to the Stratum Corneum. It exists only in the lips and thickest layers of soles and palms.

-**Stratum Granulosum**: Next deepest layer, and is a narrow strip of flattened cells containing precursor of keratin.

-**Stratum Spinosum**: The spine-like appearance of this layer is due to changes to shape of keratinocytes.

-**Stratum Basale**: The deepest layer of epidermis, consisting of a single layer of cells in a state of high vitality. These cells contain and produce normal pigment granules.

Dermis:

Under the thin epidermis lies the thicker dermis, which makes up the bulk of the skin. It varies in thickness, depending on the amount of stress and pressure the body part must endure. An example of this is the much thicker dermis found on the palm of the hand in comparison with that found on the back of the hand. The dermis consists of an upper papillary layer and a lower reticular layer. The dermis is made of mature, fibrous connective tissue that contains capillaries, sweat glands, sebaceous glands, hair follicles and nerve endings. The blood flows through the skin, which helps the skin to obtain nutrients and also helps in regulating the body temperature.

Skin covering entire body surface is the largest vital organ. The normal adult has this stratified tissue of a length of 16-20. This tissue is composed of two layers. The outer epidermis layer is protective in nature, which has no blood vessels. It is made of thick squamous epithelial cells, which forms a protective layer. It protects the body from infections, and holds in precious body fluids thus maintaining the delicate fluid balance. When an injury such as burn occurs, infection and loss of body fluid are two severe complications that cause concern.

Nerve endings in the dermis make the skin the largest sensory organ. When the dermis is damaged or destroyed, sensation is impaired or destroyed. The skin has a miraculous ability to regenerate. The process that accounts for the healing of partial thickness burns is known as epithelization.

When the burn wound is free of infection and there is good vascular bed, wounds of epithelial cells appear at the mouths of these follicles and glands, and spread rapidly by mitosis. Each source of epithelium can migrate only to a limited distance, usually about 10 mm and still produce good quality epithelium. Epithelial buds also sprout from the peripheral unburned skin. Therefore, if the burn is superficial and there is little space between epithelial buds, the burn will heal with little scarring. In deeper burns, fewer sources of epithelium survive, the wound heals more slowly, and the epithelium is of poor quality. This fragile, thin epithelium is very prone to breakdown and subsequent reinfection.

The skin is of great psychological importance. It is what we see when we look into a mirror. It is vital to our appearance and therefore, to our overall concept of self. It identifies us as a member of an individual race. When the skin is destroyed, the psychological impact on the person is great, and not to be overlooked. Often distinctive markings, such as fingerprints identify us as individual person.

Transfer of Heat to and Through the Skin

Changes which occur in the skin from burns and scalds must take into account the mode, duration and temperature of burning.

Transfer to the Skin

Heat may be brought to the skin by convection, radiation and conduction. Transfer by conduction has much greater power to heat the skin and produce burning, than that of transfer by other means.

Convection

Heat is transported by the current of the hot gas. Hot air flowing at normal eddy current (1.6 Km/ hour) transports only about 0.4 calorie per cm^2 per minute to the skin, when its temperature is 100ºC and the skin temperature 40ºC, whilst air at 400ºC temperature transports 4 calories per cm^2 per minute. As this heat is absorbed by the skin, its surface temperature rises and thus the uptake of heat gets reduced. Steam at 100ºC transports under the same conditions as much as 300ºC per cm^2 per minute, because of its high latent heat of condensation. For this reason, steam produces much severe burns than hot air.

Blasts of hot air varying from 100ºC-500ºC were used by Ashe and Roberts (1945), who studied the minimum time of exposure required to produce persistent redness and blister formation of burning in human volunteers. Persistent erythema

was caused by air at 100ºC, 200ºC, 300ºC, 400ºC and 500ºC in 4-5 seconds, 1.5 seconds, 0.6 seconds, 0.2 seconds, and 0.1 seconds respectively. Air blasts at the same temperatures caused blistering in 7-10 seconds, 2-3 seconds, 0.7, 0.25 and 0.2 seconds respectively.

Radiation

Heat energy mainly in the infrared part of the spectrum, radiated from a hot source in linear fashion, when meets the skin, a part is absorbed and a part is reflected from the surface. The rate of uptake of energy by the skin depends on the absolute temperature of the source, its radiation spectrum and effective emissivity of heat, the square of the distance between the source and the skin, the absorptivity and conductivity of skin and also on certain constants. The skin losing the heat by radiation, the effective rate of uptake is the difference between the rate of heat gain and heat loss.

The main factors which influence burning are: the source of temperature, its distance and the time of exposure. Prolonged exposure to sun's rays does not produce any burning from its heat, but the sunburn which is produced is of ultraviolet radiation.

Conduction

Heat is conducted from a hot solid or liquid medium in direct contact with the skin. The temperature of the skin surface rises instantaneously to that of the heat source and gets maintained at the same level during the period of contact. This explains why burning by immersion in hot water causes more severe burns than the spilling of water at the same temperature for the same period on the skin. Burns from the spilling of hot fluids, which rapidly evaporate, such as hot alcohol, are less severe than burns from water at the same temperature. Burns from molten metals are deep because of the high temperature of the metal and its latent heat of solidification.

Transfer of Heat through Skin

Normally the temperature of the surface of the skin is lower than the temperature of the dermis, but if heat is to be transferred from the heat source through the skin, the temperature of the skin surface must raise above that of the dermis.

Once the temperature of the skin surface is sufficiently raised, heat will flow towards the dermis and raise the temperature of the skin at different levels. The rate of transfer of heat depends on the heat capacity of the skin and on its thermal conductivity. The initial effect is a rapid uptake of the heat but after a time the skin becomes heat-saturated; the heat flow then depends on the simplified picture and is modified by various factors including the site, variations in the thickness of epidermis and the dermis, various physiological factors, such as the cooling effect of the blood flow and edema which may form during the burning episodes. For a given source of

temperature, burning by conduction has at least a thousand times greater power to injure the epidermis than burning by radiation or by convection of relatively immobile air. This is because contact and conduction raises the surface temperature of the skin immediately to that of the source whilst radiation and convection raise the surface temperature relatively slowly.

Varieties, Classification and Distribution of Burns[11]

Varieties:

Burns may be produced in a variety of ways

1. Chemical Burns
2. Electrical Burns
3. Explosions
4. Flame Burns
5. Heated solid body
6. Infra-red rays
7. LASER
8. Microwave
9. Molten Metal
10. Radiant Heat
11. Ultra-violet Rays
12. X-ray and Radium

Classification of Burns

1. Pathological
2. Clinical

Pathological:

1. Dupuytren
2. Wilsons
3. Hebra

Clinical:

1. Partial thickness burns
2. Full thickness burn

In 1832 Guillaume Dupuytren, a French military surgeon divided Burns into SIX degrees. Later Wilson (as well as Austrian dermatologist Ferdinand Von Hebra merged them into THREE degrees. To some extent the degrees of burns can be estimated by clinical assessment (i.e. Naked eye examination). More precise degree (depth) of burns can be determined by using a high frequency ultra sound device.

DUPUYTREN CLASSIFICATION:

1. **First degree**: Erythema or reddening of skin.

2. **Second degree:**

   Blister: A blister forms, which is covered by a white avascular epidermis bordered by red hyperemic skin. Blister contains exudates rich in protein and chloride Base of the blister is Red, there is capillary dilation and transudation of fluid into the tissues causing swelling, singeing of hair present. Burns is confined to epidermis repair is complete without scar formation.

3. **Third degree**: Epithelium completely destroyed, burn reaches and destroys the upper papillary layer of Dermis. Pain fibers are exposed and are the most painful burn. Shock is produced is much more than in first and second degree burns.

4. **Fourth Degree**: whole dermis is destroyed, burns are painless because pain fibers are destroyed. Appear as brownish black areas of coagulated tissues bordered by areas of reddish skin. Repair appears with scar formation.

5. **Fifth Degree**: Muscles are destroyed Burns are painless due to destruction of nerve fibers.

6. **Sixth Degree**: burns reach up to bone level they are painless and there is complete charring.

Wilsons and Hebra's classification:

1. Epidermal (First and second degrees Depuytren): The affected part is red. Generally a blister (also known as vesicle) is formed, which can be seen covered by white colored avascular epidermis with a red bordered hyperemic skin. Singeing of the hair is present. The blister contains gas and protein containing fluid. When epidermis is lost, the dermis becomes reddened, inflamed and weeps plasma and tissue fluid. These burns are found to be very painful. Repair is complete without the formation of scar.
2. Dermo-epidermal (third and fourth degrees Depuytren): Entire thickness of skin is destroyed. These burns appear as shriveled, depressed areas of coagulated tissue, bordered by reddish blistered skin. The necrotic tissue separates usually within a week and leaves an ulcer which heals with scar formation. Contraction of the scar tissue may produce disfigurement or impaired function, according to the site and size of the burns. Pain caused by this is much higher compared to first degree burns.
3. Deep (fifth and sixth degree, Depuytren): In this case, there is a gross destruction not only of the subcutaneous tissue and the skin but also of muscle and further to the bone. Nerve endings are also damaged. These kind of burns are relatively less painful. The appearances are like to those of the second degree, but in a more intensified form. The affected part is completely burnt.

Clinical classification:

1. **Partial thickness burns:**

Skin is not completely destroyed divided into:

a) **Superficial dermal**- reach the superficial layer of Dermis, they are painful as nerve endings are exposed. They heal spontaneously without scarring within TWO weeks.

b) **Deep dermal**- They reach the deep layers of Dermis they are painless, healing occurs in FOUR weeks and is frequently followed by formation of a hyper-trophic scar.

2. **Full thickness burns :**

Entire epidermis and dermis is destroyed the thrombosed vessels are seen muscles and bones may be visible with loss of all sensations. The diagnosis of the depth of burn is not entirely accurate because there are no definite clinical criteria for the depth of burn. There are various gradations of injury in the extensive burn, also the thickness of the skin varies with the age and body location. One depth of injury fades away into the other in such a way that definite demarcation and gradation is almost impossible.

The best way of differentiating a second and third degree burn is by pulling out hairs, if the hairs are pulled out easily and painlessly, it indicates as a third degree burn. At present burns are classified into superficial and deep. Superficial when less

than full thickness of the skin is involved and deep when the whole skin and/ or the deeper tissues are involved.

Degree of Damage	**Dupuytren's Classification**	**Wilson's Classification**	**Modern reference classification**
Superficial redness	1st degree	Epidermal	Superficial
Vesication	2nd degree		Superficial
Destruction of superficial skin	3rd degree	Dermo epidermal	Superficial
Destruction of whole skin	4th degree		Deep
Destruction of muscle	5th degree	Deep	Deep
Complete charring	6th degree		Deep

Effects of Burns:

Effects of Burns depend on the following factors:

A) Surface area:

- Rule of nine (Wallace)
- Rule of Palms
- Lund and Browder chart

B) The degree of heat

C) The duration of exposure

D) Age

E) Sex

F) Site of burns

A) **Surface area**: Total surface area of body in adult is 1.8 sq.m.surface area of burns is measured by following methods. The distribution is usually expressed as a percentage of the total area of the body surface (BSA). Berkow presented data concerning percentage surface of various parts of the body. The rule of nine first devised by Pulaski and Tennison divides the body surface into multiples of "nine" per cent.

Rule of '9'

Area	**% of Burns**
Head and neck	9 %
Chest – Front	9%
Chest – Back	9%
Abdomen - Front	9%

Abdomen - Back	9%
Upper limb – Right	9%
Upper limb – Left	9%
Right lower limb – Front	9%
Right lower limb – Back	9%
Left lower limb – Front	9%
Left lower limb – Back	9%
Genitalia	1 %
Total	**100 %**

Rule of Palms:

Palmar surface of patient (including digital surface area) is roughly equal to 1 % of his own body surface area. Useful in case of isolated and scattered burns.

Lund and Browder Chart:

Is the most accurate in measuring percentage of Burns and is widely used in everyday clinical practice. It takes into account the fact that three areas of body- Head, Thigh and Leg- have different areas during different ages, they are designated as A, B, C respectively, and their body percentage is read directly from table. Other areas such

as neck (1%) anterior chest and abdomen (13%), upper limbs (10 %) etc., have fixed percentage.

Age	At birth	1 year	5 years	10 years	15 years	Adult
A	9.50	8.50	6.50	5.50	4.50	3.50
B	2.75	3.25	4.00	4.50	4.50	4.75
C	2.50	2.50	2.75	3.00	3.25	3.50

Degree of Heat:

Higher the heat more severe the damage.

Temperature for producing the Burn:

- Less than 44^0c burn cannot be produced as heat is conducted away via the capillaries of the skin. 44^0c minimum temperature required to cause burn.
- Between 44 – 51^0c, increase in temperature by 1^0c half the duration of exposure necessary to cause same amount of burns.
- At 65^0 c only TWO seconds required for burns.
- Greater than 70^0c instantaneous

Duration of exposure:

Higher the duration, more severe the damage.

Age:

Adults are less susceptible. Children are most susceptible.

Sex:

Women are found to be most susceptible.

Site of Burns:

Burns on Head and Neck area, Face, Trunk and abdominal wall (Anterior) are more damaging.

Probability of Death in Burns:

Three most important indicators of death after thermal injury:

1. Total body surface area
2. Age
3. Inhalation injury

BAUX Score:

Percentage of mortality = age + % of body burned

A **revised Baux score** takes into account the inhalation injuries.

Mechanism (cause) of death associated with burns[7,12-15]

1. Immediate Causes:

a) **Primary (neurogenic) shock**: Occurs instantaneously from fear or inhibition from severe pain resulting in vaso-vagal shock or reflex cardiac arrest. Sudden reduction of venous return to heart due to neurogenic vasodilatation occurs. Psychological factors, such as fear, grief, anxiety, emotion and pain due to various causes play a large part.

b) **Secondary shock**: If the patient survives from primary shock, serum loss from burnt area and consequent depletion of blood volume. There is progressive circulatory failure diminished perfusion of the tissues, reduction in oxygen consumption of interference with enzyme system, acidosis, and electrolyte imbalance.

c) **Suffocation**: Apart from the actual burning, death may occur from asphyxia (suffocation) due to breathing of the smoke, which contains CO_2, CO and other products of combustion.

d) **Accidents or injuries**: Accidental injuries from falling structures while trying to escape from the spot.

II Delayed Causes:

a) **Toxemia**: This could persist up to 3-4 days due to absorption of several metabolites from burnt tissue.

b) **Sepsis**: The chief danger to life is the occurrence of sepsis in burnt area and intercurrent disease especially of respiratory system. In case of deaths occurring after 4 to 5 days or longer after burn injuries, this was found to the most important factor in deaths.

c) **Biochemical Disturbances**: These may occur post fluid loss and tissue damage e.g., K^+ increase occurs initially, Na^+ loss, Cl^{++} loss and hypoproteinemia are the common biochemical disturbances due to burn injury.

d) **Acute renal failure**: Owing to general toxemia arising from destruction of tissues may lead to acute tubular necrosis in about 3-4 days time.

e) **Gastrointestinal disturbances**: Acute duodenal ulceration (Curling's ulcer), dilatation of stomach and severe hemorrhage occasionally develop in 1-2 weeks, after severe burns.

f) **Other complications**: Pulmonary embolism, fat embolism, thrombosis due to extensive tissue damage and immobility for longer period.

Tetanus, gangrene, erysipelas are the other complications and suppurative discharges lasting for several weeks may lead to amyloidosis and exhaustation due to prolonged starvation.

Histological changes in burned skins:

Epidermal Changes:

The stratum corneum is often loosened into its component layers due to expansion of the keratin and its temporary transformation into a semi plastic material. The small zone of disintegrative necrosis at the junction between viable and heat coagulated epidermis is seen sharp.

Histologically, superficial burns may be defined as those in which the deeper part of the epidermis, particularly the basal-cell layer, remains viable and is not affected either by disintegrative necrosis or by heat coagulation.

Human skin blisters readily, probably due to superficial capillary network in the dermis, and the blister fluid exudes and collects below the epidermis, as the cementing membrane between dermis and epidermis gets destroyed.

Dermal Changes:

The dermis is affected in all burns which produce primary heat necrosis of the whole epidermis and blister the skin. The severe effects are seen near the surface layer, and the deep layers of dermis are least affected, and the middle zone changes are seen

intermediate in severity. The damage in partial thickness of skin loss, burns usually affect the sheaths of hair follicles, sebaceous glands and ducts of sweat glands.

The vertical gradient of heat downwards in the thickness of dermis may cause heat coagulation, heat disintegration and reversible cellular changes. The extent of skin loss depends upon the extent of dermal epithelial necrosis. Histologically, in a full thickness skin loss, irreversible changes involve all the dermal epithelial elements. The other signs of irreversible damage usually noted are rupture of the fatty cells of the sebaceous glands and distortion of the sheaths of the hair shafts and the presence of small rents with fissures in the epithelium of the follicles.

Heat coagulated nuclei are often greatly found elongated and distorted with their faint outlines. Necrotic changes in the form of karyolysis, karyorrhexis and pyknosis may be seen.

Pathophysiology Effects of Burns: [13,16]

Skin:

One of the most important functions of the skin is acting as a protective barrier against invasive infection by pathogenic organisms. Unwounded skin also has a thermo-regulatory action, controlled by a delicate vasomotor mechanism with sweating as a valuable control mechanism in the thermo-regulatory function. Elevation of body temperature above certain limit results in disturbance of thermo-regulatory action.

When heat is conducted into the body at a finite level to which core temperature can rise; above which survival of individual is no longer possible.

Third critical function is that of ability of the skin to limit evaporative loss of water from the body surface. It has been shown that burning destroys a hexane-soluble liquid contained within the normal skin, resulting in transmission of water vapor at a rate of at least four times as rapid as that of normal skin. Increased transmissivity of the skin in respect of water vapor touches top level about the 4th day of burns.

Evaporative water loss rate from the burnt surface is roughly proportional to the depth and extent of the burn. Increase in evaporative water loss in the burn injuries patient greatly enhances heat loss. Evaporative loss in burns can be estimated by multiplying the body surface area (BSA) by the quantity 25% burns.

Vascular Injury:

The post-burn phase is marked by alterations in cardiovascular function, marked by extensive increase in capillary permeability, due to injury to vascular endothelium. The vascular system in the burnt area immediately becomes permeable to fluids, electrolytes, and molecules. The increase in capillary permeability occurs throughout the vascular system. Its onset is almost immediate around the area of the burn, but delayed in other parts of the body for several hours after the burn. The net effect of this increase in capillary permeability is of extravasation of fluid into the interstitial space. Fluid loss through the injured capillaries is essentially isotonic to plasma in

respect to electrolytes. Some loss of plasma proteins also occur through the injured capillary bed and the resulting protein content of the extravasated edema fluid is approximately 3 gm per 100 ml.

The increase in capillary permeability is greatest immediately after the burn injury and gradually returns to normal by approximately 24-48 hours after the injury. The result of extravasation of fluid through the damaged capillaries is hypovolemia with the volume loss, primarily in the plasma fraction of whole blood. The blood volume deficit resulting from capillary derangement is roughly in proportion to the depth of burn.

The plasma volume loss in the first 24 hours after burn injury results in a significant decrease in the cardiac output. A second factor adversely affecting the cardiac plasma of the burned patients. Studies have shown that perfusion of normal animals with the blood from burned animal will cause a similar decrease, thus incriminating a substance circulating in the blood. This material appears to have a direct depressant effect on the isolated myocardial muscle. The substance is dialyzable with a molecular weight below 1000. At the present time there is no known specific therapy to combat the effect of this myocardial depressant.

A second critical aspect of the burn injury with regard to the vascular system is its effect on formed elements of the blood. Although, capillary permeability is markedly increased in individual, the increase is not sufficient to allow escape of larger

molecules and the cellular elements of the blood from the vascular system. There is, however, a significant decrease in the total mass of the circulating cellular blood elements. In patients with extensive burns an initial 8% to 10% reduction in total red cell mass can be demonstrated.

The mechanism thought to be involved in this initial red cell mass destruction include direct hemolysis by heat; sequestration of injured red cells by the reticulo-endothelial system with subsequent destruction; trapping of red cells, platelets, and white cells in the microvascular thrombi of damaged blood vessels; and the effective removal of red cells from the circulating red cell mass by the phenomenon of sludging. Subsequent to the initial destruction of red cell mass by the mechanism described, a further decrease will be noted over succeeding days and weeks as a result of diminished red blood cell life span. This diminished life span appears to be caused by a circulating plasma factor. Red cells injected from a burned patient into a normal patient show normal survival, but the injection of red cells from a normal patient into a burned patient reveal a striking reduction in red cell survival.

During the first 48-72 hours following burn injury, a mild thrombocytopenia can also be demonstrated, which may be masked by the early haemo concentration resulting from the plasma volume loss. Reduction in platelet count is probably explainable, at least in part, on the basis of observed microvascular thrombosis and disseminated intravascular coagulation.

Inhalation Injury:

Pulmonary damage due to smoke inhalation and carbon monoxide intoxication is found to be the leading reasons of death in fire victims. There are two distinct mechanisms of pulmonary injury following inhalation. (1) Carbon monoxide and smoke toxicity. Some toxicity is further divided into (a) direct injury and (b) smoke poisoning. Carbon monoxide, the most common basis of death in burn victims is clearly a very distinct cause of inhalation injury and is quite different in its pathophysiology from either direct injury, or smoke poisoning. Some poisoning is due to noxious chemicals formed in the burning process and is particularly prevalent when organic compounds, such as plastics undergo combustion.

Carbon Monoxide:

The biologic effects are due to tissue hypoxia. When Carbon-monoxide combines with blood, it forms carboxy-haemoglobin (HbCO), dropping the oxygen carrying capacity of the blood and competes with oxygen for the available haemoglobin binding. The affects with oxygen for the available hemoglobin binding. The affinity of hemoglobin for CO is 300 times much higher than for O2. Due to this, HbCO concentration is very high in comparison although carbon monoxide concentration is fewer than 5% in gas inhaled. Toxicity will be dependent on the concentration of the gas in the inhaled air at the time of exposure. Factors that potentiate the effects of

carbon monoxide include decrease in oxygen content in the burning room and the additional pulmonary effects of smoke poisoning.

The upper limit of safety is 0.01% in air. Exposure to environment containing 0.2% gas can cause death within ~4 hours; 0.4% within an hour; and 1.0% in 20-30 minutes.

Direct Injuries:

Inhalation of hot dry air (at 205^0C or higher) does not seem to have much effect on the lower respiratory tract. This hot air may lead to tissue damage in the upper airway and larynx, by causing laryngeal spasm, edema and possible suffocation, but since the heat capacity of the air is small, most of the heat is dissipated in the nasopharynx. In the presence of water vapour (steam), thermal damage to the more distal lung tissues can occur, since steam has a much higher heat capacity than doe's dry air.

Progression of fire in a closed, consumes oxygen, and the heat at the ceiling of the room may reach 1000^0F or greater. When combustion is incomplete considerable soot and particulate matter is formed. Most of these particles, as they are inhaled are filtered in the upper airway but some of them may reach the lower airway and cause direct damage to the mucosa since they are superheated. It is also highly likely that, these particles has toxic agents which causes smoke poisoning. Examples of these toxic agents include SO_2 and NO_2, phosgene, chlorine, etc. which adhere to the soot.

In the presence of water they form corrosive acids and alkalis that are extremely toxic to the mucosa. The extent of the injury caused by this direct mechanism is not known, but is greater than once appreciated.

Smoke Poisoning:

In addition to carbon monoxide, thermo degradation of natural and synthetic materials results in the production of noxious gases. Natural materials include oxides of sulphur and nitrogen, aldehydes, etc. One of these aldehydes, acrolein, in a concentration of 5.5 parts per million (ppm) has been shown to cause irritation of the upper respiratory tract, with pulmonary edema occurring at 10 ppm in exposure times of as little as a few seconds.

Noxious gases from the pyrolysis of man-made polymers include hydrogen cyanide, hydrocarbons and halogens. Some of these plastics also produce large amounts of benzene and HCN. As benzene is an anesthetic substance, it is possible that, this allows the corrosive acids and alkalis to flows through respiratory tract all the way to alveoli and gets absorbed. More recently, it has been discovered that the addition of phosphorus fire retardant to plastics may produce even more lethal noxious gases including phosgene and related substances.

Pathophysiology due to 'CO' Poisoning:

Carbon monoxide causes no pathological change to the tracheobronchial tree. The pathological picture following inhalation of soot particles and/or noxious

gases is difficult to separate, since there is considerable overlap and the soot particles may actually be carrying the great majority of the toxic gases.

The immediate effect of the inhalation of smoke is the loss of ciliary action and severe mucosal edema. Within seconds surfactant activity in the lung is severely compromised, resulting in congestion with micro and sometimes macro-atelectasis. If the inhalation injury is severe, there may be damage to alveolar and bronchiolar epithelium. Within minutes, there is a detectable bronchiolar obstruction. After several hours, sloughing of the tracheobronchial mucosa begins and a mucopurulent membrane develops. Following pseudo membranous tracheal bronchitis, there is necrotising bronchiolitis, hyaline membrane formation, intraalveolar haemorrhage, fibrin thrombus formation and finally alveolar pulmonary edema.

Study of smoke and carbon monoxide poisoning victims show that most victims die within 12 hours and a small number with respiratory tract pathology. Most patients died of hypoxia. The patients without pathological findings probably die of carbon monoxide poisoning. Conversely, those dying after 12 hours will have more respiratory tract pathology including bronchopneumonia. This last finding is probably uncommon in pure inhalation injury and represents sepsis and the effects of treatment interventions, such as tracheostomy and ventilators.

The above picture is complicated if the patient has also sustained thermal injury to the skin. This will lead to damage on the vascular side of the ventilation

perfusion pathway. The combination of resuscitation disseminated intravascular clotting, micro emboli and probable burn toxins may lead to increased capillary permeability, interstitial oedema and alveolar flooding. It is also known that skin burns depress the immune system, particularly cells, (cell-mediated function). This undoubtedly sets the stage for the development of bronchopneumonia and sepsis.

Post Mortem Examination of Burn Case

The findings vary considerably and depend on the extent of the fire, how long the person lived during the fire, and how long the burning went on after death. A complete post-mortem examination should be carried out, even if the body may be very severely burnt, for information of considerable value may be obtained.

External Examination

Clothes:

The clothes should be carefully removed and inspected for the presence of combustible substance like Kerosene and Petrol. The pattern of burns on the clothes may provide vital information on the manner the Cloth was ignited, the position of the victim, the path taken by flame, and possibly the presence of the inflammable material.

When the clothes of the victim catch fire, the burnt area show marked localisation. The burns are generally found on areas covered by loose clothes. Parts of the body protected by tight clothing, such as the belt, shoes, brassiere or buttoned collar are apt to escape.

Skin:

Clothes if any should be carefully removed, and skin is examined.

Burn by flame: Blisters may be produced.

- "Singeing" of hairs present
- Skin Blackening may be found.

By heated solid: May produce reddening, charring or blistering according to its **shape.**

By explosive: Very extensive burn, blackening, tattooing may be present.

By Kerosene: Burns will be very extensive, smell of kerosene may be present; sooty blackening of parts.

The body gives a strong smell of burning of the burns are ante-mortem in nature. The affected burned areas will be either charred, blistered or reddened. Blisters can be either ruptured or collapsed.

Blisters are due to increased permeability of the superficial blood vessels due to heat. They contain serious fluid of a jelly-like consistency and are rich in albumin and chlorides. The blister fluid coagulates on heating or on treatment with nitric acid.

Hairs: Look for singeing or bulbous at intervals. Colour of hair may change in light hair. There may be carbon-aceous material on body.

Extent of Burns: Is determined by Wallaces formula of '9'. The armpits, axilla, perineum, etc. may escape from burn injury.

Degree of Burns: It is assessed depending on burn injury to epidermis of deeper structures.

General appearance in Burns: The face is found swelled and disfigured and the tongue projected out. Owing to the effect of heat on the blood, the veins stand out giving a marbled appearance. Skin of the hands may detach like gloves. Tattoo marks may be visible even after removal of superficial layer.

Blisters: When blisters burst, they results in raw surface which are pale moist. This in turn becomes yellow and then turns to dry, brownish, leathery surface.

P.M. Lividity: It may be cherry red in colour due to possible 'CO' poisoning.

In case of death after about 2 days of burns, pus may be seen in burn wounds and in cases of death after few days, there may be sloughing and granulation tissue.

Pugilistic Attitude: The body presents a peculiar attitude, the so-called attitude of defence, known as boxing attitude, pugilistic attitude or fencing posture. It is due to heat stiffening. Since the flexors contract more than the extensors, the body presents an attitude of generalised flexion. This attitude of the body is present whether a living body is burnt or a dead body is burnt and has therefore no medico-legal significance. The condition is due to coagulation of proteins other than those affected by rigor mortis. It is different compared to rigor mortis in that it is permanent and does not pass off. The limbs are flexed with the fists clenched and the body slightly bent.

Heat Ruptures: The skin is tense, leathery, hard, and frequently shows splits owing to tension and these may be mistaken for wounds, like laceration or incised wounds.

It may be distinguished from violence. (1)By the presence of nerves, blood vessels and connective tissue running across the split from side to side, (2) there is no clotted blood in these fissures and no extravasation of blood in the adjoining tissues as heat coalesces the blood in the vessels, and (3) There is no bruise marks or any other signs of critical reaction in the margins of heat rupture.

In Scalding Cases: In case of scalding, the liquid responsible may be seen on the clothes and the body. Sometimes, its smell may be obvious. The skin is sudden and bleached and vesication is seen along the course taken by the liquid. Burning of clothes, singeing of hair, deposition of carbonaceous material and charring of tissues are not seen. Since the hot fluid or steam is cooled by passage through the clothing, the distribution of scalds is normally on the unclothed portions of the body. Likewise, hot liquid is cooled while being dispersed. Therefore, scalds are more severe at the place where hot liquid has come into initial contact with the skin. As the liquid runs down the body, the degree of scalding also progressively diminishes.

Age of Burns: Age of burns can be determined by sequence of reparative process.

The ageing of the burns is very imprecise and be determined by the agents, the extent of the depth and the health of the individual.

Immediate	**Redness of skin**
In about 1 hours	**Vesication.**
In 12 to 24 hours	**Exudate begins to dry**

2 to 3 days	**Dry brown crust.**
In 36-72 hours	**Red inflammatory zone disappears and pus may form under sloughs.**
In 4 to 6 days	**Superficial slough separates. (one week)**
In 2 weeks	**Deep slough separates.**
After about 2 weeks	**Granulation tissue covers the surface.**
Several weeks	**Scar formation takes place**

II-Internal Examination

The findings will depend upon whether death has resulted from (1) shock, (2) asphyxia, or (3) whether the individual has survived the immediate effects of burning, and (4) has died from subsequent complications, such as inflammation of the serious surfaces, septicaemia, pneumonia, or acute tubular necrosis. The internal organs are very much well preserved even in case of external charring. This is due to the reason that the body tissues are generally very poor heat conductors.

Blood:

There may be haemoconcentration and hypovolaemic polycythemia.

If significant level of COHb in blood is present, the blood will be in fluid state and cherry-red in colour. Look for smell, colour, emboli in vessels etc.

Cranial Cavity:

When head is exposed to intense heat, there may be fissures in scalp and curved fractures of skull vault and sometimes, a thin layer of extradural haemorrhage commonly seen in parieto-temporal regions, which may be mistaken for violence.

The extravasation of blood, it usually brick-red or reddish brown deposit on the upper surface of Dura mater and may be leathery. The brain may be shrunken or may be oedematous and congested, or cooked with yellow to light-brown colour. When the head is exposed to extreme heat, the extradural blood underneath looks like a cooked spongy mass, which is soft, friable clot and chocolate in colour. This has been called "heat haematoma". Clot has a honeycomb appearance, and it is not closely related to the position of the fracture site.

Two types of thermal fracture of skull found: (1) Fracture results from the rapid increase in intracranial pressure and the fracture fragments are displaced outwards, (2) Fracture caused due to quick desiccation of the bone with shrinkage fracture involves only the outer part of skull. In this case, there is no displacement, and lines of fractures are mostly "stellate" shaped.

Curiously, heat fractures generally do not involve the skull sutures even in younger age individuals with open sutures. Heat fractures may cross suture line.

Thoracic Cavity:

Respiratory System:

Soot in air-passages: If death occurs due to suffocation, aspired blackish coal particles along with mucus are noticed in mouth, trachea, nose, larynx, bronchi, oesophagus, and stomach. These particles are embedded in frothy mucus which is seen covering the congested mucosa. Presence of soot in the terminal bronchioles is a solid proof of life during burning event.

In the absence of Carbon Monoxide in blood and presence of soot in air passages, the death may be due to CO poisoning.

Inhalation of superheated air causes severe congestion, oedema, or destruction of vocal cords, or trachea, and bronchi.

Lungs and Pleura: Pleura may be congested.

Lungs: Lungs are usually congested, shrunken and rarely anaemic; sometimes oedema of lungs occurs. Lung Vessels may have smaller amount of fat caused by disturbance in fat metabolism. Petechial haemorrhages may be seen over the pleurae.

Heart: Heart is usually filled with clotted blood or left side chambers may be empty; Petechieal haemorrhages in endocardium and pericardium may be seen.

Abdominal Cavity

Liver: Usually congestion and enlargement is seen.

In longstanding survival Liver may exhibit necrosis, cloud like swelling, fatty changes due to suboptimal nutrition, and hypoxaemia. Jaundice may be seen.

Spleen and Lymph Nodes

Usually spleen becomes enlarged and softened. Lymph nodes show necrosis of lymphoid germinal centres.

Gastrointestinal System

Inflammation and ulceration of patches of Peyers and solitary glands can be noticed inside the intestines.

Curling's Ulcers – Occasionally, multiple haemorrhagic ulcers are formed in the stomach and duodenum about the 10th day in burns of extensive nature. Curling's ulcers are generally sharply punched out mucosal defects, and it may be superficial or deep. Petchiae of GIT is a more common finding.

Kidneys: Kidneys are usually slightly enlarged and cut surface bulges out, due to the fact of dilatation of tubules. Interstitial edema may also be seen. Cortex appears pale due to little blood in it with blurring of normal radial pattern. Medulla is often seen dark and congested. The kidneys may also show tubular necrosis, cloudy swelling, capillary thrombosis and infarction. Haemoglobinuria happens in case of 30% of surface skin burned.

Adrenals: Adrenals are usually enlarged, and congested. Haemorrhages are common both in cortex and medulla.

Uterus and Ovaries: They may be congested or pale. Look for evidence of pregnancy, or any disease. Examine the endometrium, fallopian tubes. If embryo or

foetus is present, determine the age. In the case of death from scalding, the internal appearances are not specific.

Medico-legal Aspects of Burns

The forensic pathologist is normally concerned only with fatalities due to burns or with circumstances in which bodies are recovered from burning buildings. The following questions therefore require to be determined when a dead body is recovered from fire:

(1) Identity of the deceased,

(2) Whether the burns are ante-mortem or post-mortem?

(3) Whether the burns are the cause of death, and

(4) Whether the burns are suicidal, homicidal or accidental?

Identification:

Frequently, in severely burned bodies, tissue fluid collects between the layers of the skin. In case of hands where in the skin damages to the extent of getting detached like a glove including the fingernails, either the detached glove or the remaining hand whichever is less damaged may be used to obtain fingerprints. The skin of the feet may detach in like fashion. Wiping of areas thought to be tattooed, may reveal a tattoo mark previously obscured.

When complete incineration of a body has occurred, identification is extremely difficult but in such cases, every fragment of bone, teeth, metal articles, etc., should be

carefully retained for examination. The non-pregnant uterus and the prostate may not undergo incineration even in severe burning and help in determination of sex.

Ante-mortem or Post-mortem burn

A person may have been murdered and the dead body could have been burnt to conceal crime. The differentiation hinge on the noticeable vital reaction as seen by the eye or found by histological examination.

The following table differentiates features of ante-mortem from post-mortem burning.

S. no	**Trait**	**Ante-mortem burns**	**Post-mortem burns**
1	Redness lines	Present; Absence in case of immediate death.	Absent
2.	Blisters (Vesication)	A) Base is red and inflamed. B) Contain exudate, which is rich in protein and chlorides. C) Show hyperaemia around. D) Blisters formed by scalds have	A) Base is pale, dry and hard. B) Contains air. C) No hyperaemia around.

		same characteristics.	
3.	Vital reaction	Marked inflammatory reaction. Leukocytic infiltration occurs immediately.	None
4.	Enzymes	Peripheral zone of burn shows increase in reparative enzymes.	No such increase
5.	COHB	Present	Absent
6.	Internal organs	Congested	Usually roasted and emits peculiar odour
7.	Blood	Cherry red	Not so
8.	Soot particles in air passage	Present	Absent

Burning as a cause of death:

The presence of ante-mortem blisters, finding particles of soot in the air passages and stomach and cherry-red colour of blood due to the presence of carbon monoxide are sure signs of death from burning as a result of configuration.

Suicide, Homicide or Accident:

Suicidal burning:

Is relatively common among Indian women, mostly due to domestic worries, or the problem of dowry. In suicide, the circumstances are usually will be evident and perhaps the most frequently used method of doing this is to soak the clothes in kerosene and then to set them on fire. It is very difficult to extinguish such flames caused by Kerosene.

Homicidal Burning:

Homicidal burning or scalding is rare, but cases were recorded where fire, hot metal, corrosive substances and boiling water have been used with intent with intent of killing. Among grownup females, burns are caused on the pudenda linking to adultery punishment. Deliberate scalding by hot fluids, burns caused using cigarettes, and burning of the buttocks and other areas using hot plates and radiator bars are sickening examples of this form of child abuse. Bodies may be burned after death to hide homicidal injuries. Irrespective of the severity of the surface destruction, the organs are mostly well preserved. Burning might conceal evidence of strangling, but other injuries like fractures, or bullets cannot be easily concealed with burns.

Accidental:

They account for a very large proportion of burns and scalds. The deaths are seen most frequently in infants, children and aged persons. Accidental deaths from burns occur when person are under the influence of drugs or alcohol. Accidental scalds are common in kitchen.

REVIEW OF LITERATURE:

Dasgupta SM,Tripathi CB [3] (1984) in a study of "Burn Wife Syndrome"reported that out of 87 burnt married Females autopsied,95.4% belonged to Hindu religion. Only 3.45%were Muslims and 1.14%came from Sikh community.59%of burnt wives were illiterate, 23%received only primary education and 16% were educated up to secondary standard and only 2% victims were graduate.

Sakhare S [29] (1985), In a study of 1,200 suspected deaths of newly married in Vidharbha region of Maharashtra state in our country, showed that the major portions of the married burnt females were illiterate. She also found that 76 graduate and post graduate degree holders also in this fray. In her study that dowry deaths in lower middle class were to extent of 40% while middle and lower groups were 30% each.

Tahuja R [30] (1987), in a study of "Violence against women: A sociological perspective study", observed that middle class women had a higher rate of victimization than lower or upper class women.

Gupta RK and Srivastava AK [19] (1988) dealt with "epidemiological and medico logical aspects of 180 cases of fatal burns" in Kanpur during one year (Oct 1985 to Sep 1986) period. The study constitutes 10.79% of the total autopsies, majority of the

victims were of Hindu religion house wives burned within five years of marriage. It was found the common source of fire was mostly cooking gadgets. Victims were poured with Kerosene oil and fired with matchstick. Half of the burnt cases were accidental.

Lerer LB [21] (1994) in his study of burn cases admitted in Salt River State Mortuary, Cape Town, South Africa between 1st Jan 1991 and 31st Dec 1992 mentioned that 44% had soot particles in the trachea and main bronchi in homicide associated burns.

Satpathy DK [8] (1995) in his medico legal study on "Burning Brides" commented that the most common reasons given in post-mortem reports was being that of they caught a spark (a) while doing cooking, (b) after an oil burst in a stove or (c) when a lamp fell on the person at night. The enquiry performed with relatives or neighbors generally reveals the above explanations are not true.

Dhattarwal SK [18] (1997) analyzed upon medico-legal deaths and 1154 postmortems during the year 1992 occurring at Pandit BD Sharma, PGIMS, Rohtak, where serious medico-legal cases from all over Haryana state are referred and admitted. In maximum number of cases the burns as cause of death especially in young females outnumbered other causes of suicide. Accidental cases were 471, suicidal 227 and homicidal 81.

Nagesh Kumar Rao [22] (1997) in a study of "Fatal Female Burns" in Manipal stated that 80 cases out of 352 medico-legal autopsies were victims of burns. The burns in

female is more found in age group of 19-39 years, of that highest proportion was observed in age group of 19-25 years (26.7%). This concludes that during the initial seven years of marriage, this is more common.

Dalbir Singh et al [17] (1998) in their analysis of autopsy records of 240 burn victims admitted in Nehru Hospital of PGIMER, Chandigarh during the period of November 1996 to November 1998 reveals that the majority of burn deaths occurred in the productive age group of 15-40 years (83.0%) with peak incidence at 21-30 years (43%). The most common factor in burns death (82%) was Kerosene. Majority of the females sustained burn during day time. In woman, the cases of burn death was high (73%) in those living along with their family; most of the female victims were house wives (65.7%). The majority of death due to burns occurred by one week (65%) of the incidence, septicemia was the primary cause of death (53%).

Tripathi CB et al [23] (1999) in their "Sociological Study on Burnt Wives", which comprised of 152 autopsy cases during 13.06.1987 to 03.02.1989 in the mortuary of Department of Forensic Medicine, IMS, BHU, Varanasi, 136 cases (89.47%) of the burnt married woman were within 35 years of age and most of the burnt wives were Hindus 14 (92.76%) followed by Muslims 10 (6.5%) and only one Christian. Out of 152 fatally burnt females examined, 70 cases (46.05%) deaths were accidental followed by 47 homicidal burns (30.92%) and 32 suicidal burns (21.05%). Majority of burns death i.e., 111 (72.02%) were in the rural, the burn deaths distributed in

urban area were 33 (21.71%).Almost half 74 (48.68%) of the incidence occurred within 5 years period of victims marriage.

Kumar V.Tripathi et a [28] (1999),In their Sociological study of burnt wives, out of 152 autopsies of burnt married females reported the educational background of the victims as illiterate 53.28%,primary 21.71% and junior high and high school 25%.

Tripathi CB et al[24] (2000) in the study of "Burns" observed 152 cases of medico-legal autopsy held in the mortuary of the Forensic Medicine Department, BHU, Varanasi during 13.06.1987 to 03.02.1989. Out of 152 cases, 70 (48.05%) died accidentally followed by 47 (30.92%) homicidal and 32 (21.05%) committed suicide. Smell of kerosene oil was found in as many as 41 (26.9%) of cases. Most of the victims 130 (85.52%) were having more than 50% body area burnt. About 47 (30.92%) victims died due to septicemia.

Mohanty MK et al [26] (2005) in a 11 years study on suicide by burning found that, out of a total of ~340 burns deaths, only 39 were suicide victims. The major part of deaths (46%) occurred in the 21-30 years age group. In all cases, kerosene and flames were used. In more than 50% cases, the TBSA involved was higher than 80%.

Ambade VN et al [27] (2006) in a study on trends of burn deaths. 384 victims of burns deaths were analyzed. The age group of most of the victims were between 11-40 years with majority of them at 21-30 years (47.0%). Accidental burning (75.0%) was the most common of burn deaths followed by suicides and homicidal burning. Kitchen

(69.3%) was place of burning for most, and Sari was the most common clothing carrying the burns.

Dr.N.P.Zanjad and DR.H.V.Godbole [31] (2007) in a study of fatal burns cases in autopsies carried at Nanded (India) during the period of three years. The peak incidence in 21-30years (39.50%) of age group. Rural area (73%) formed the bulk of the cases. More than 80% total body surface area involved was noticed. In 41.4%cases, majority of the victims died as a result of flame burns (92.30%), followed by electric burns (5.3%) and scald (2.4%). Accidental burns were most common (70.8%), followed by suicidal (18.2%) and homicidal burns (10.9%). The majority of deaths due to burns were observed within a week (66.2%).

Dr.H.M.Mangal et al [32] (2007) in a study of The fire is both A blessing and scourge to the mankind, the study was conducted in department of forensic medicine PDU Medical college, Rajkot during the period of November 2004 to October 2005 with a view to study the profile of burn cases brought for the post mortem examination.300 burns cases selected for the study. The peak incidence in 21-30years(39.7%) of age group followed by 31-40 years(19.6%).Total body surface area involved was 40-60% 1n 55%cases.Majority of the subjects died as a result of flame burns(98%).Accidental burns were most common(61%),followed by suicidal(35%) and homicidal burns(4%).

A.K.Srivastava and P.Arora [33] (2007) in a study of Suspicious deaths in newly married females-A medico legal analysis, in 72 burns cases, Majority of deaths were Accidental(52%),followed by suicidal(27%) and homicidal(21%).

Akther J.M.Nerker et al [34] (2010) in a study of Epidemiology of burned patients admitted in burn unit of rural tertiary teaching hospital at Mahatma Gandhi institute of medical sciences, Sevagram between April 1999 to march 2003. In 714 burn patients, In their study, 70.3% belongs to low socioeconomic status, while 62.32% were illiterate 92.58% of burn injury were accidental nature. Flame burns constitute about 87.82% cases. Septicemia 42.21% was most common modality of death. In 456 females, peak incidence of occurrence between 5A.M to 10A.M (47.4%) followed by between 11P.M to 4A.M (29.8%).

Dahal P and Paudel BR [35] (2010) in a study of Pattern of burn patients admitted in burn unit of Bir hospital Kathmandu, between April 2007 to April 2008, in 56 female patients, the peak incidence in 16-25 years (39.3%) of age group followed by 26-35 years (32.1%).Majority of the subjects died as a result of flame burns (80.3%).

Jyosthna Devi Ande et al [36] (2011) in a study of Pattern thermal burn injuries and their outcomes at burn care unit of tertiary hospital, Warangal, from January to July 2013,in 69 burn patients, majority of them are home makers(56.5%),students are(13%), labour (7.2%),business(4-3%)and others were 18.8%.

Vaghela Prithvirajsinh C et al [37] (2012) in a study of study of Epidemiology of fatal burn cases in G.K.General Hospital, BHUJ, between January 2008 to December 2011,in females, lower socio economic status are 49.4% followed by middle 47% and upper 3.6**%.** Most of the cases were from rural area (74.5%). Majority of incidence occur at home (92.4%).

Mostafa M.Afify et al [38] (2012) in study of Fatal burn injuries: A five year retrospective autopsy study in Cairo city, Egypt, Analysis between 2006 to 2010, Majority of incidence occur at home(92.4%) Peak incidence occur at winter season(41.5%) followed by summer(24.5%),autumn(17%)and spring(17%).Majority of them occur at night time(53.8%).Flame burns constitutes 87.82%cases. Majority of deaths were suicidal (37.2%) followed by Accidental (32.6%) and homicidal (30.2%). The majority of deaths due to burns were observed within a week (82%).Soot in airways and or digestive tract in 60.4% cases.

S.Lal et al [39] (2012) in a study of mortality pattern of burn patients admitted in S.G.M.Hospital Rewa, During the period from 2004 to 2009, in 482 females, the source of burn in majority of cases are flame from indigenous kerosene lamp (32.1%) followed by chullha (28.9%), pouring of kerosene oil on body (16.9%), Kerosene oil pressure stove (13.1%), LPG cylinders(3.8%) and others(1.1%).

Arpan Mazumder,Amarjyott Patowary [40] (2013) in a study of pattern of burn injury cases, study undertaken at the mortuary of forensic medicine, Gauhathi medical college hospital

during the year 2011,Hindu community comprising 79.3% out of 242 cases out of the 242 cases, the rest were from Muslim community. As for the nature of injury, accidental burns topped in list with 229 cases (95%) the rest being suicidal in nature. Soot particles were found in trachea in only 18.5%cases.

Shinde A.B. Keoliya A.N.[41] (2013) in a study of Socio-demographic characteristics of burn deaths in rura India, Study carried out in the department of forensic medicine at B.J.medical college,Pune during the period of 2 years from October 2006 to October 2008, 110 cases studied, In females The peak incidence in 21-30years(50%) of age group followed by 31-40 years(20.2%). In 94 females, peak incidence of occurrence between 10P.M to 06P.M (46.8%) followed by between 06A.M to 2P.M (26.6%) and between 2P.M to 10P.M (26.6%). Majority of incidence occur at home (97.4%).Majority of deaths were Accidental (50%) followed by suicidal (22.3%) and homicidal (9.6%).

Shinde A.B. and Keoliya A.N.[42] (2013) in a study of Burn Deaths with Special Reference to histopathology in India, study carried out in the department of forensic medicine at B.J.Medical college, Pune during the period of 2 years from October 2006 to October 2008, 110 cases studied, histopathological changes in kidneys showed cloudy degeneration in 17(15.45%) cases, tubular casts in 35 (31.81%) cases, acute pyelonepritis in 10 (9.09%) cases, regeneration of epithelium in 15 cases (13.63%) and acute tubular necrosis in 18(16.36%) cases.

Harish D et al [43] (2013) in a Comprehensive analysis of deaths due to burns in a tertiary care centre at Government medical college and hospital, Chandigarh during the period of January 2011 to July 2013, In females, the peak incidence in 21-30years(42%) of age group followed by 31-40 years(20%). Majority of newly married women are house wives (84%) and most of the cases were from rural area(64%). In general Majority of them belongs to Hindu community(61%) and the source is the fire in cooking purposes(83%) and Majority of deaths were Accidental(81%) followed by suicidal(10%) and homicidal(9%).

Pandey SK, Chaurasia N [44] (2014) in an epidemiological Retrospective study of Thermal Burns at Department of forensic medicine, IMS, BHU, Varanasi for the period of 2 years i.e.2009 and 2010. In females the peak incidence in 21-30 years (46.9%) of age group followed by 31-40 years (20.2%). Peak incidence occurs at summer season (43.6%) followed by winter (29.5%) and rainy (26.9%).

Dr. Awdhesh Kumar [45] (2015) in a study Unnatural death due to fatal burn in females in Varanasi, A five year retrospective autopsy study at Department of forensic medicine, IMS, BHU, Varanasi from 2009 and 2013. In females the peak incidence in 21-30years (54.1%) of age group followed by 31-40 years (18.3%). Most of the cases were from rural area (93.15%). Majority of them belongs to Hindu community (97.24%) and Majority of deaths were homicidal (97.24%) followed by Accidental (2.49%).

MATERIALS AND METHODS

Material for the present study comprise 80 cases of death due to burns brought to the mortuary of Government Kilpauk Medical College Hospital, Chennai were studied. All case records in the mortuary files were studied for fatalities due to burns trauma over a period from September 2014 to August 2015.

The data consists of:

1. Detailed examination of the deceased who died due to burns were subjected to the autopsy during the prospective study period.
2. Inquest papers and relevant police documents.
3. Case history papers and other relevant hospital documents of the victims.
4. Postmortem report of the above said cases.
5. Photographic equipments are used for recording burnt areas of the body.
6. Slide sent for pathology department for histopathological examination of kidneys.
7. The statistical analysis of the data was done and presented as results and observations in tabular form, graphs and charts.

Figure-1: DISTRIBUTION OF BURNS.

Figure-2: DISTRIBUTION OF BURNS.

Figure-3: HOMICIDAL BURNS.

Figure-4: SINGEING OF SCALP HAIR

Figure-5: BURNS WITH GREENISH YELLOW SLOUGH

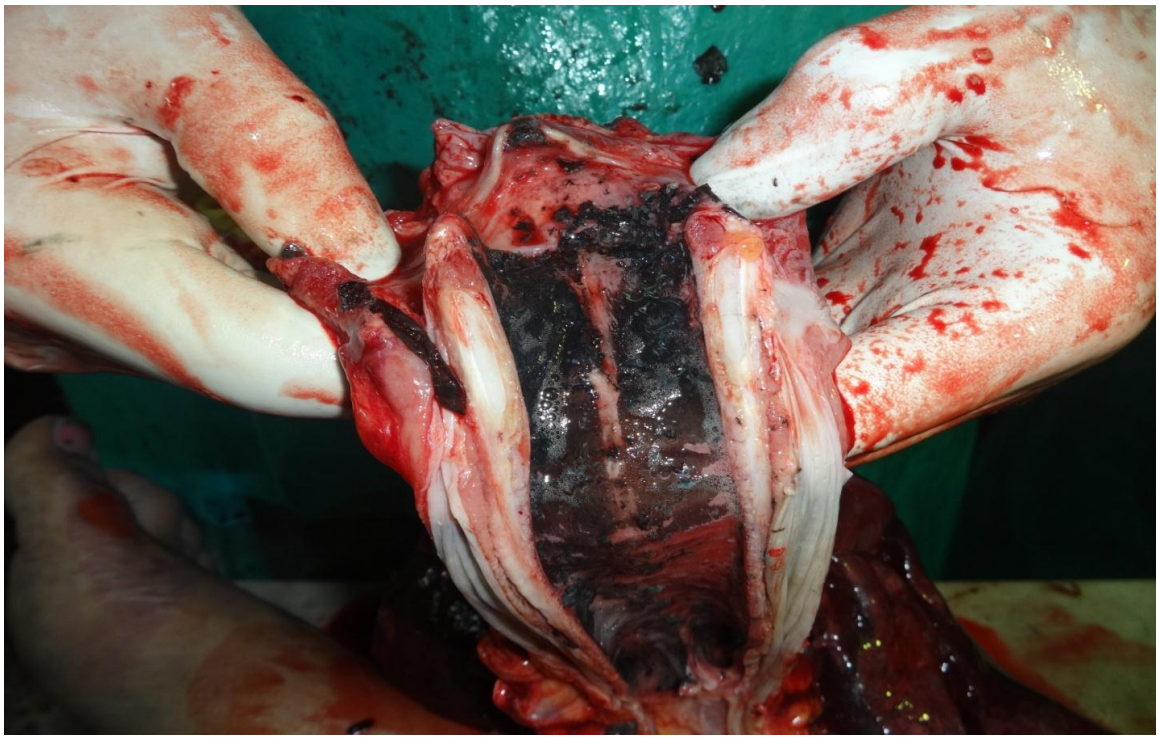


Figure-6: SOOT PARTICLES IN TRACHEA

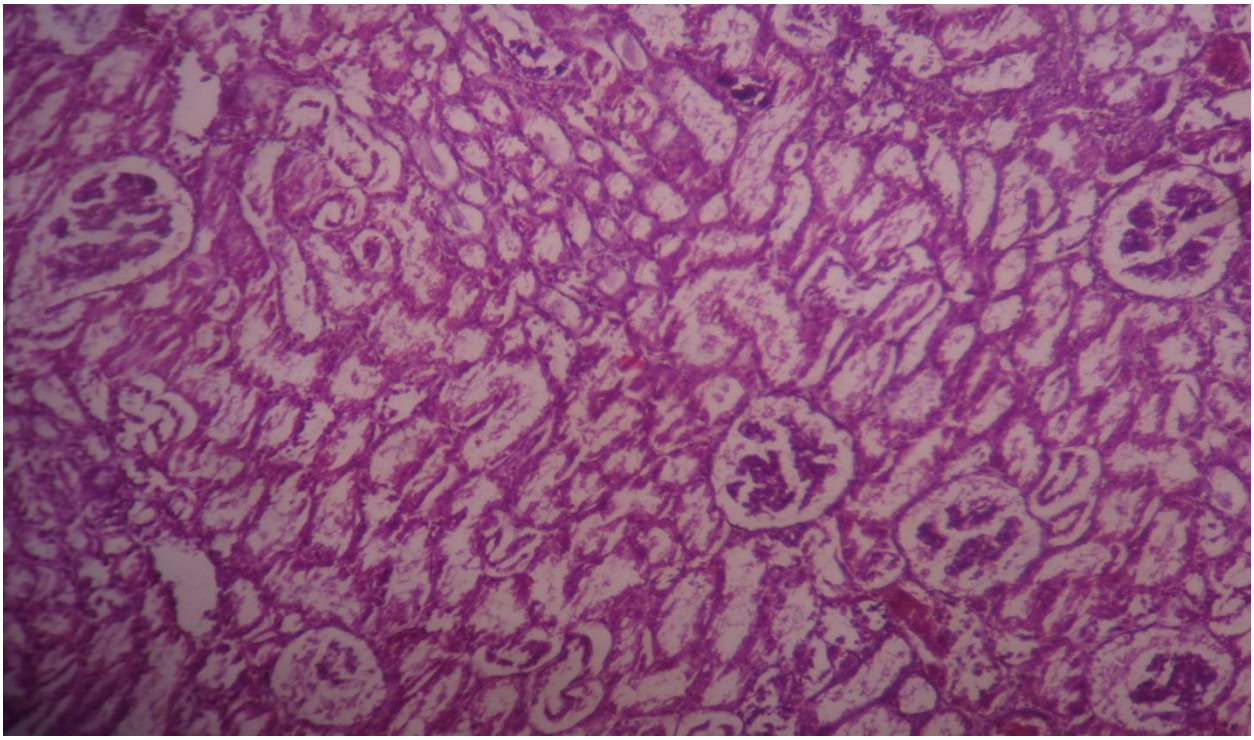


Figure-7: HPE: CLOUDY DEGENERATION OF KIDNEY.

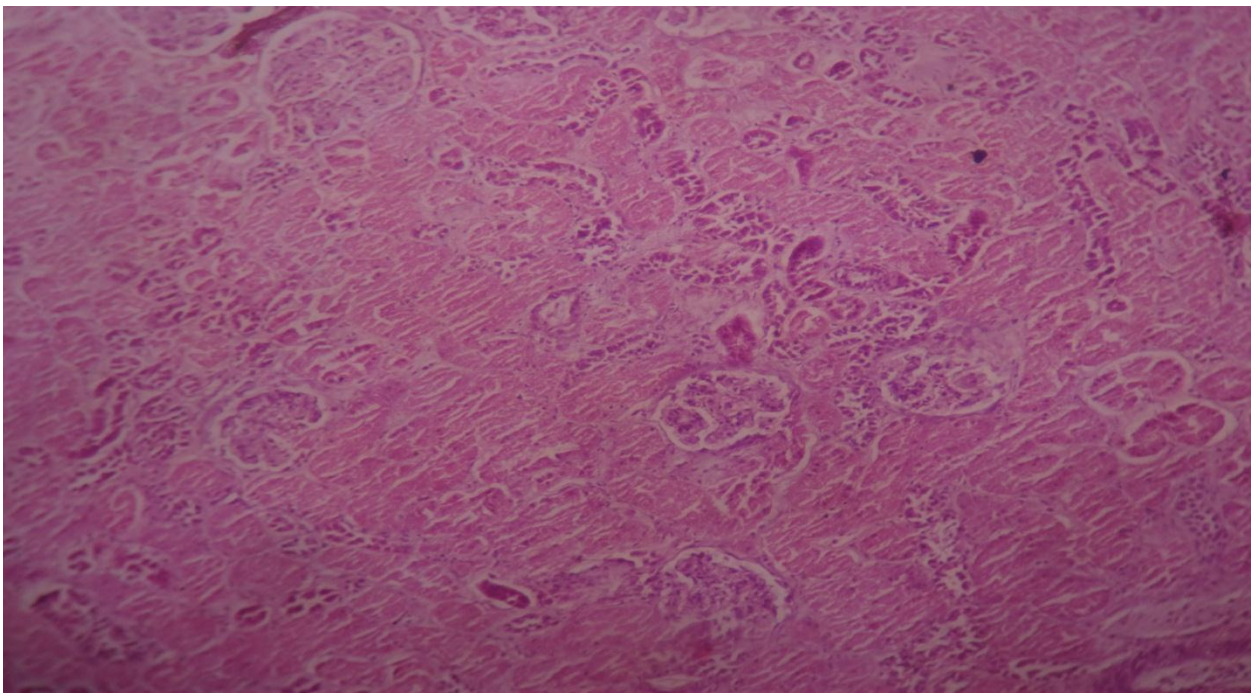


Figure-8: HPE: ACUTE TUBULAR NECROSIS

RESULTS

Table-1: Age Range - Distribution

Years	No. of cases	%
18-20	3	3.75
21-30	43	53.75
31-40	31	38.75
41-44	3	3.75
Total	80	100.00

From the above table, it can be noted that maximum number of deaths i.e., 43 (53.75%) occurred in the age group between 21-30, then followed by 31-40 age group.

Figure-9: Age Range - Distribution

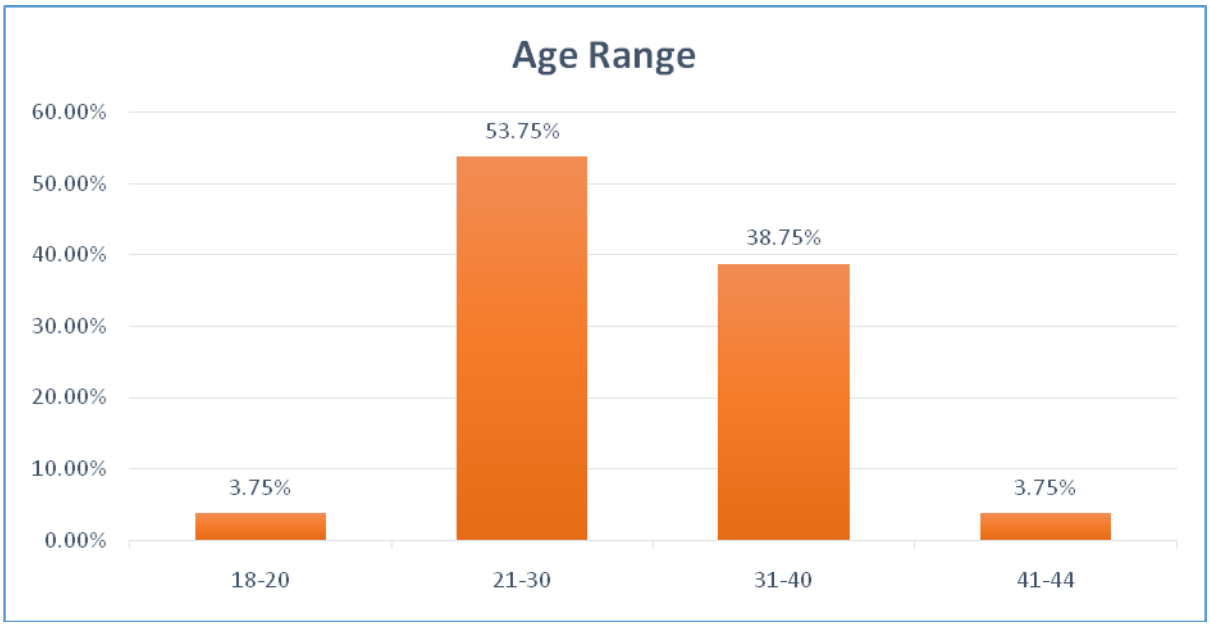


Table-2: Religion - Distribution

Religion	No. of cases	%
HINDUS	67	83.75
MUSLIMS	7	8.75
CHRISTIANS	6	7.5
OTHERS	0	0

The above table shows majority of the burn victims belong to Hindu religion.

Figure-10: Religion - Distribution

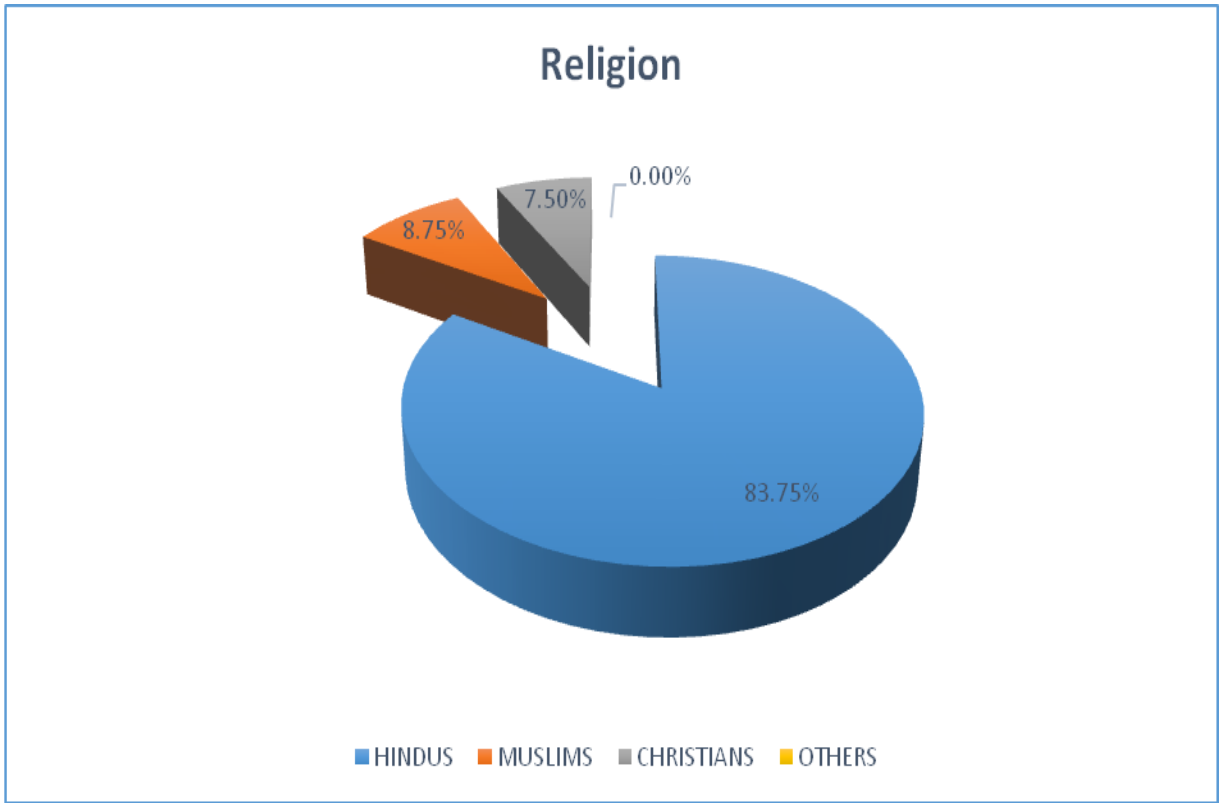


Table-3: Occupation - Distribution

Occupation	No. of cases	%
HOUSE WIFE	**74**	**92.5**
LABOURER	**4**	**5**
BUSINESS / JOB	**2**	**2.5**

The above table shows that 92.5% of the victims were house wives.

Figure-11: Occupation - Distribution

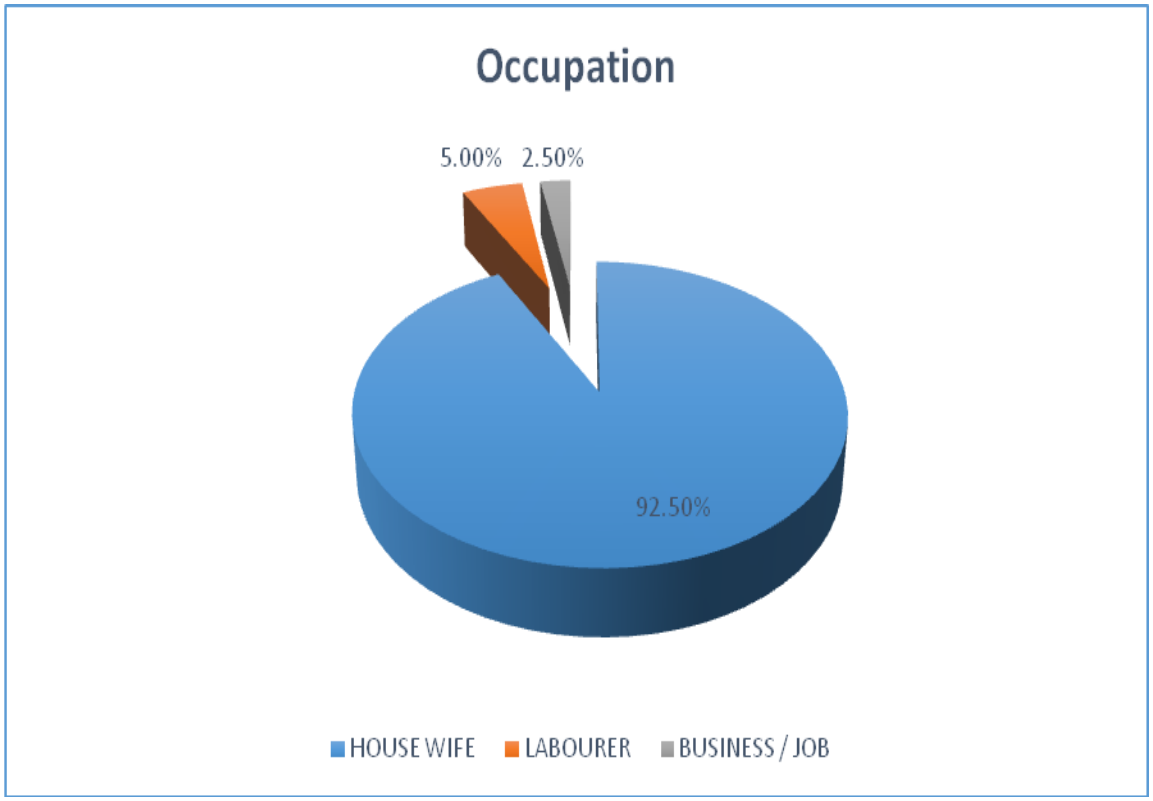


Table-4: Marital Status - Distribution

MARITAL STATUS	No. of cases	%
LESS THAN 7 YEARS	26	32.5
MORE THAN 7YEARS	54	67.5

The above table shows that out of 80 females, 54 (67.5%) were belongs to the category of marital age belongs to >7 years of marriage.

Figure-12: Marital Status - Distribution

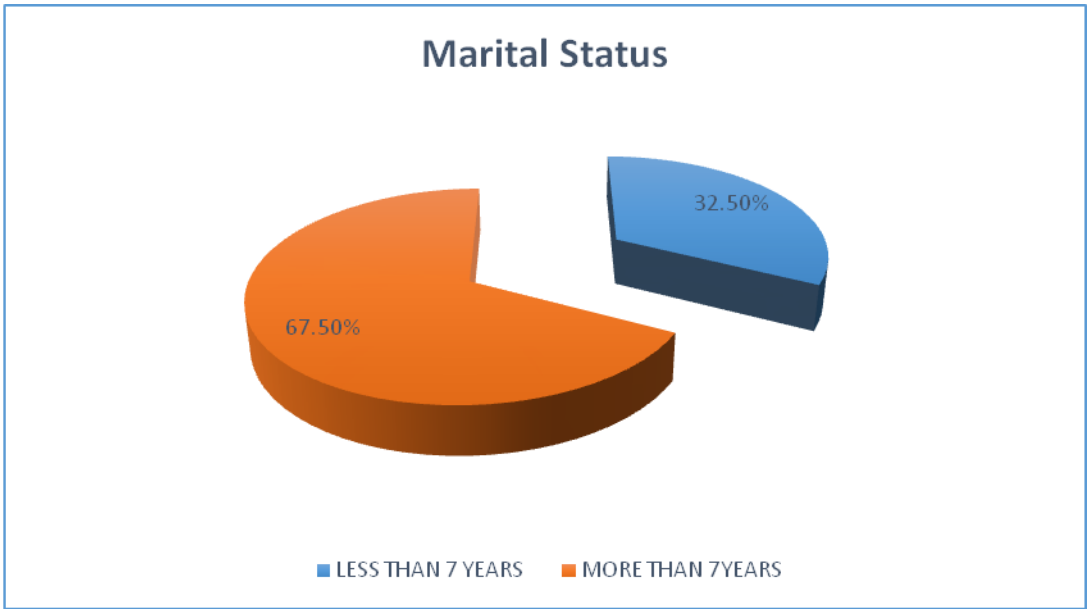


Table-5: Socio-Economical - Distribution

SOCIO-ECONOMICAL STATUS	No. of cases	%
UPPER	0	0
MIDDLE	5	6.25
LOWER	75	93.75

The above table shows that maximum cases (93.75%) belongs to low socio economic status group.

Figure-13: Socio-Economical - Distribution

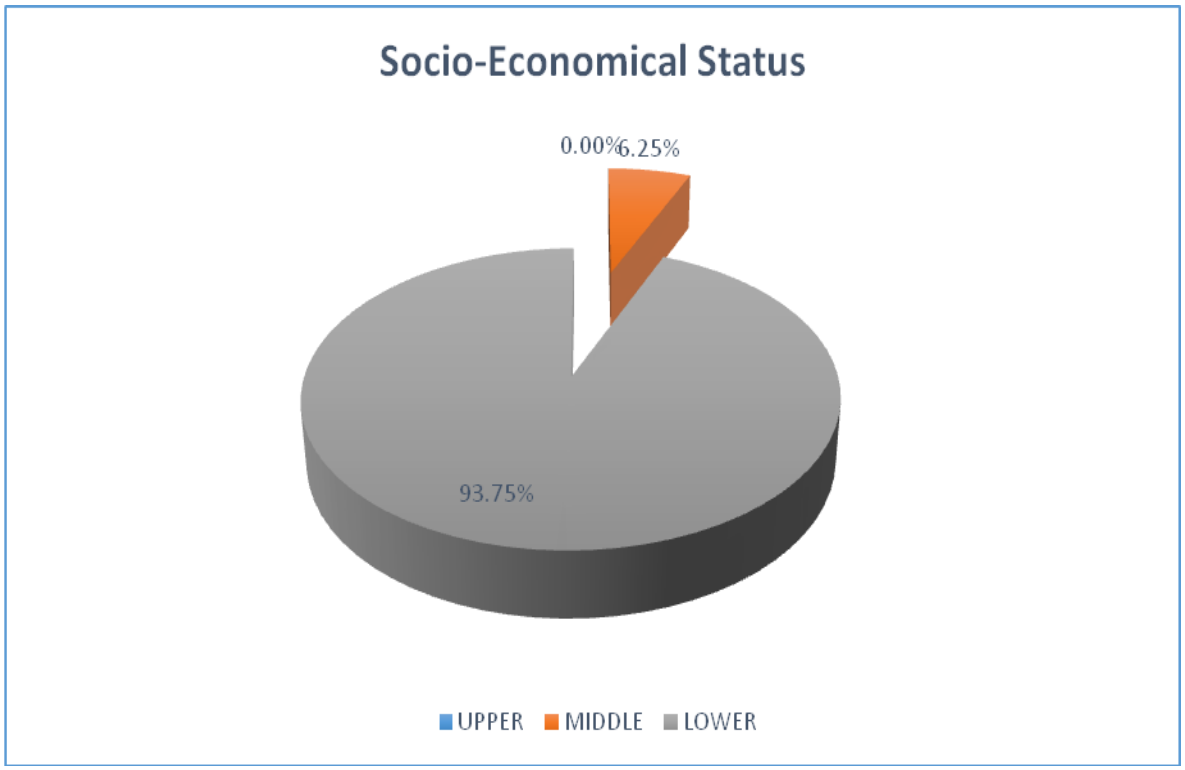


Table-6: Domiciliary - Distribution

DOMICILIARY	No. of cases	%
URBAN	33	41.25
RURAL	47	58.75

The above table shows that majority (58.75%) belongs to rural area.

Figure -14: Domiciliary - Distribution

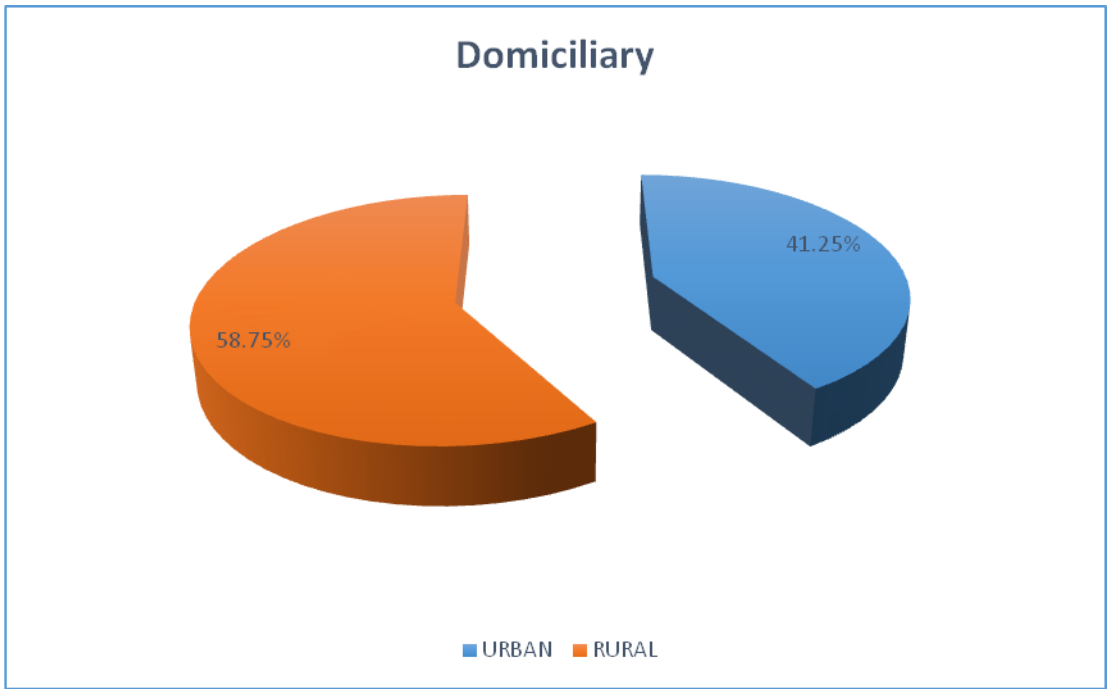


Table-7: Educational status- Distribution

	No. of cases	%
PROFESSIONAL	**0**	**0**
GRADUATE/P.G.	**3**	**3.75**
I.M./DIPLOMA	**2**	**2.5**
HIGH SCHOOL	**26**	**32.5**
MIDDLE SCHOOL	**8**	**10**
PRIMARY SCHOOL	**25**	**31.25**
ILLITERATE	**16**	**20**

The above table shows that maximum cases belong to high school education (32.5%) followed by primary school education (31.25%).

Figure -15: Educational status- Distribution

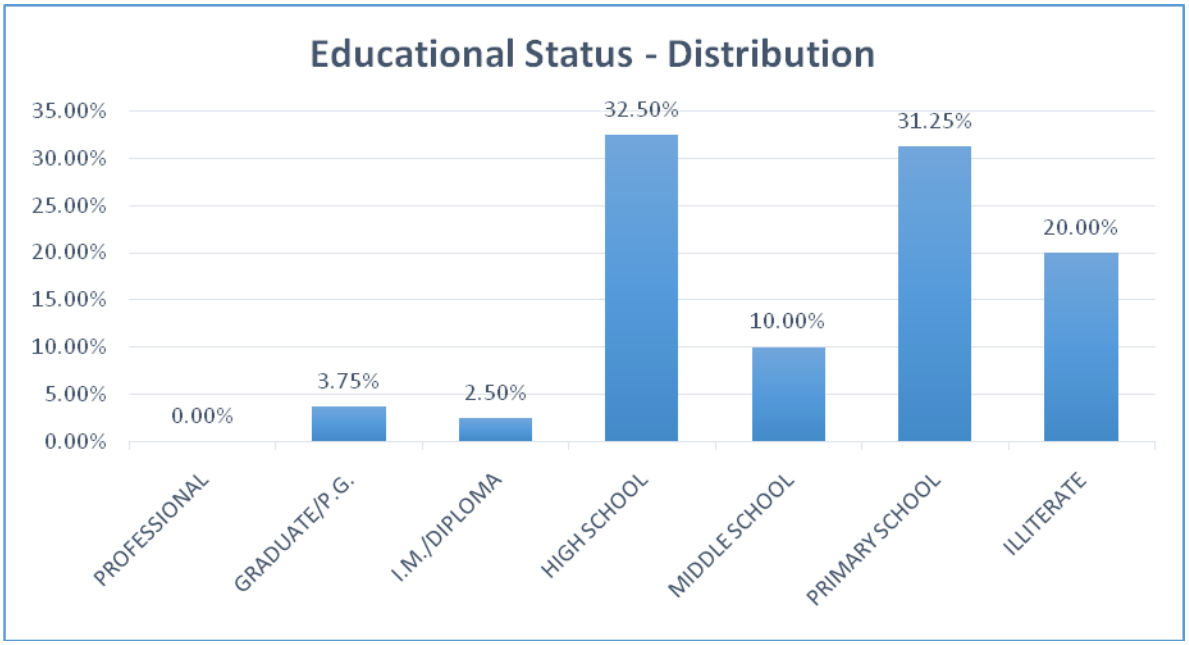


Table-8: Place of Incidence - Distribution

	No. of cases	%
HOME	**75**	**93.75**
WORKING PLACE	**-**	**-**
OUTSIDE	**5**	**6.25**

The above table shows majority of burn incident occur at home (93.75%).

Figure-16: Place of Incidence - Distribution

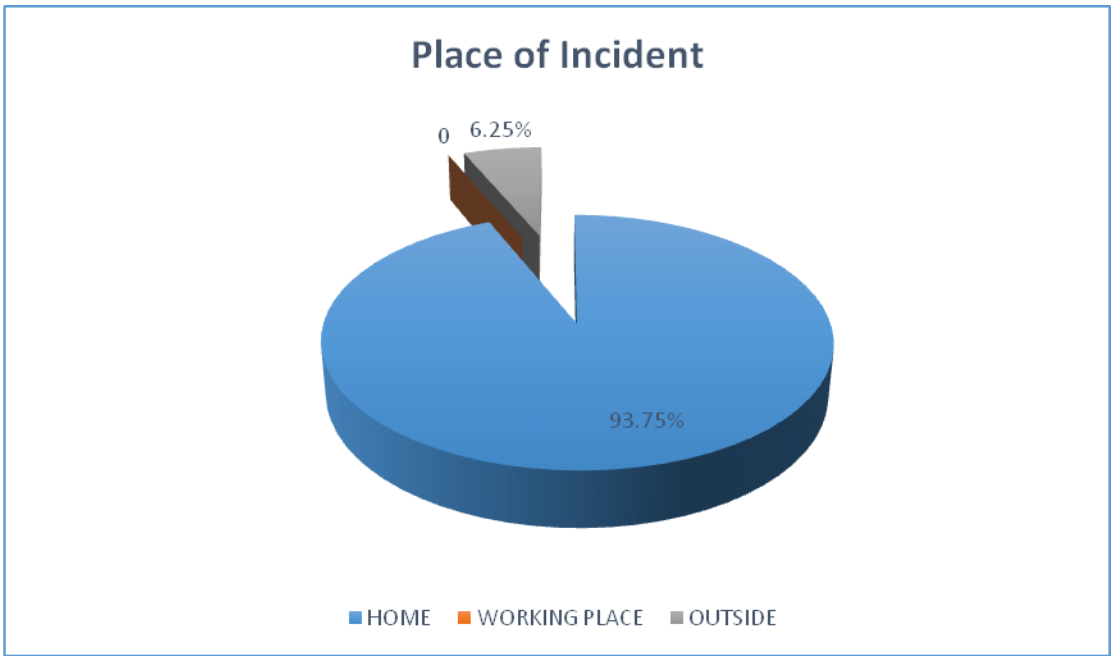


Table-9: Seasonal variation:

	No. of cases	%
SUMMER	**31**	**38.75**
RAINY	**12**	**15**
WINTER	**37**	**46.25**

The above table shows that maximum incident occurred at winter season (46.25%) followed by summer (38.75%).

Figure-17: Seasonal variation:

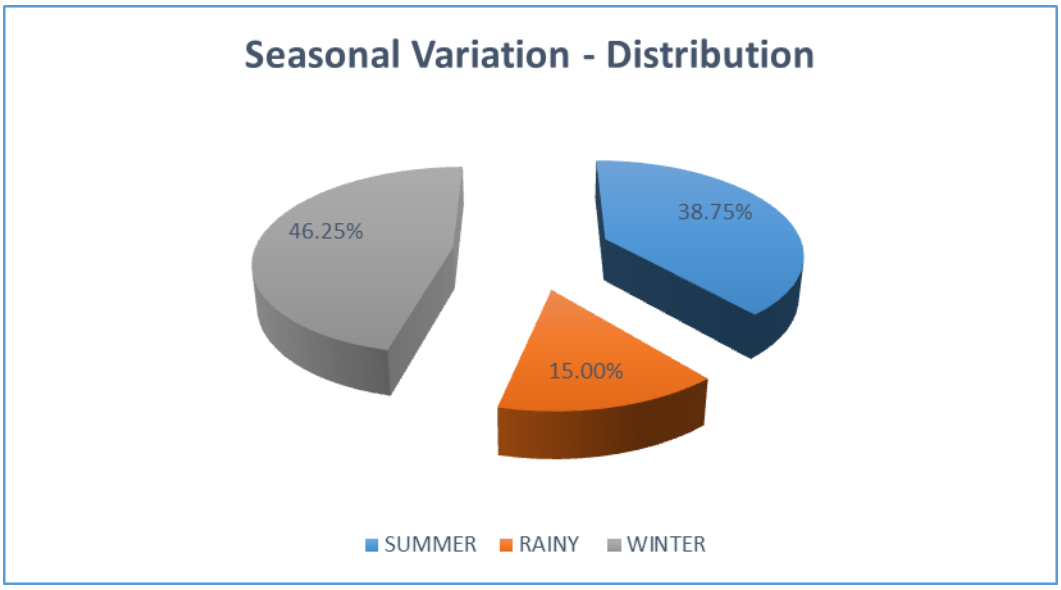


Table-10: Time of incident:

	No. of cases	%
5 A.M. TO 10 A.M.	14	17.5
10 A.M. TO 4 P.M.	22	27.5
4 P.M. TO 10 P.M.	28	35
10 P.M.TO 5 A.M.	16	20

The above table shows majority of incidence occur between 4 P.M. to 10 P.M (35%) followed by 10 A.M. to 4 P.M. (27.5%).

Figure-18: Time of incident:

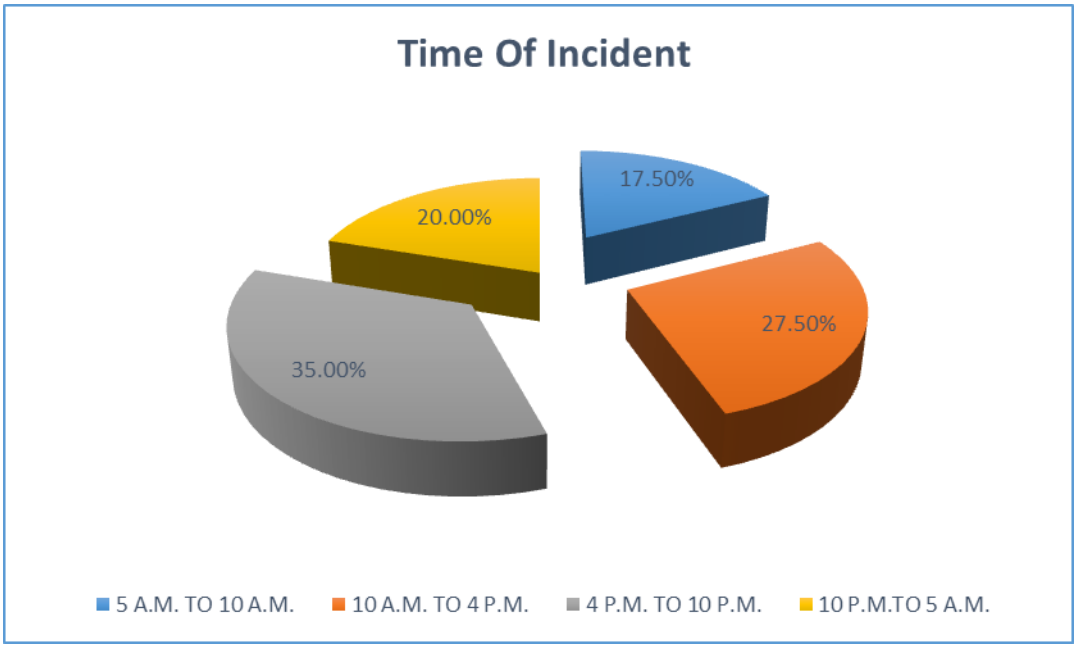


Table-11: Manner of death:

	No. of cases	%
ACCIDENTAL	**34**	**42.5**
SUCIDAL	**44**	**55**
HOMICIDAL	**2**	**2.5**

The above table shows more number of women died of suicidal burns (55%) followed by accidental (42.5%) and homicidal (2.5%).

Figure-19: Manner of death:

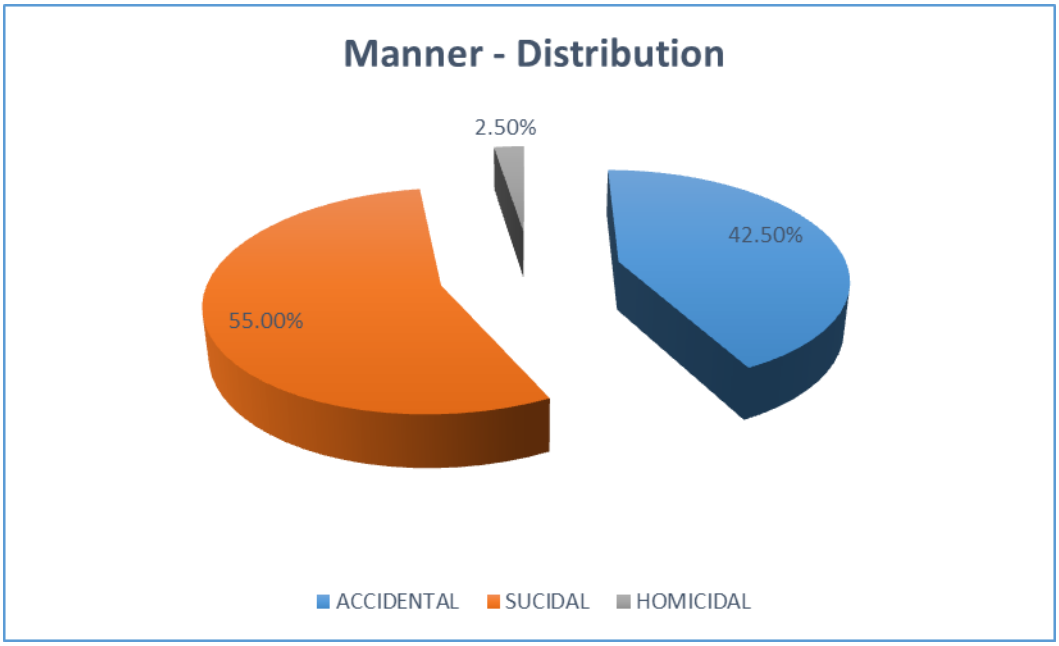


Table-12: Type and source of burn:

TYPE	SOURCE	No. of cases	%
FLAME	KEROSENE OIL / PRESSURE STOVE	24	30
	LPG CYLINDER	3	3.75
	POURING OF KEROSENE OIL	45	56.25
	INDIGENOUS CHIMNEY LAMP	2	2.5
	OTHERS	6	7.5
SCALD	-	-	-
ELECTRIC	-	-	-
CHEMICAL	-	-	-

The above table shows all the incidents were due to flame. Pouring of kerosene oil were seen in majority of cases (56.25%).

Figure-20: Source of burn:

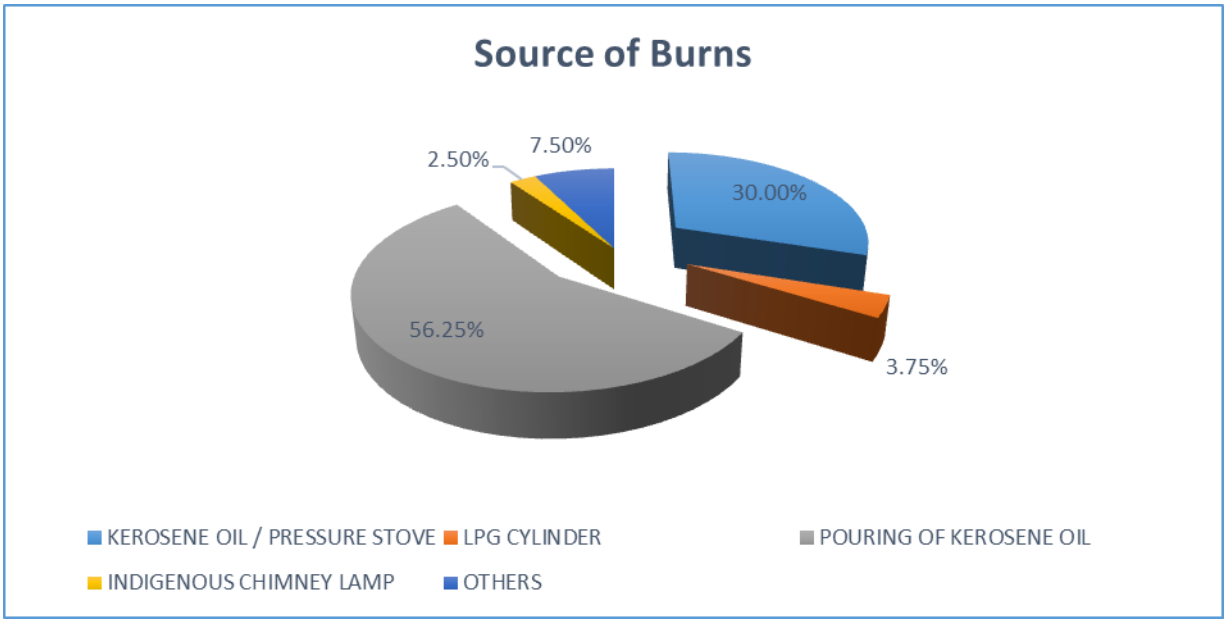


Table-13: Total Body Surface Area – Distribution

	No. of cases	%
0-20%	**-**	**-**
21-40%	**11**	**13.75**
41-60%	**23**	**28.75**
61-80%	**16**	**20**
81-100%	**30**	**37.5**

The above table shows the TBSA involved was more than >80% in 37.5% cases whereas 28.75% cases were involved 41-60%.

Figure-21: Total Body Surface Area – Distribution

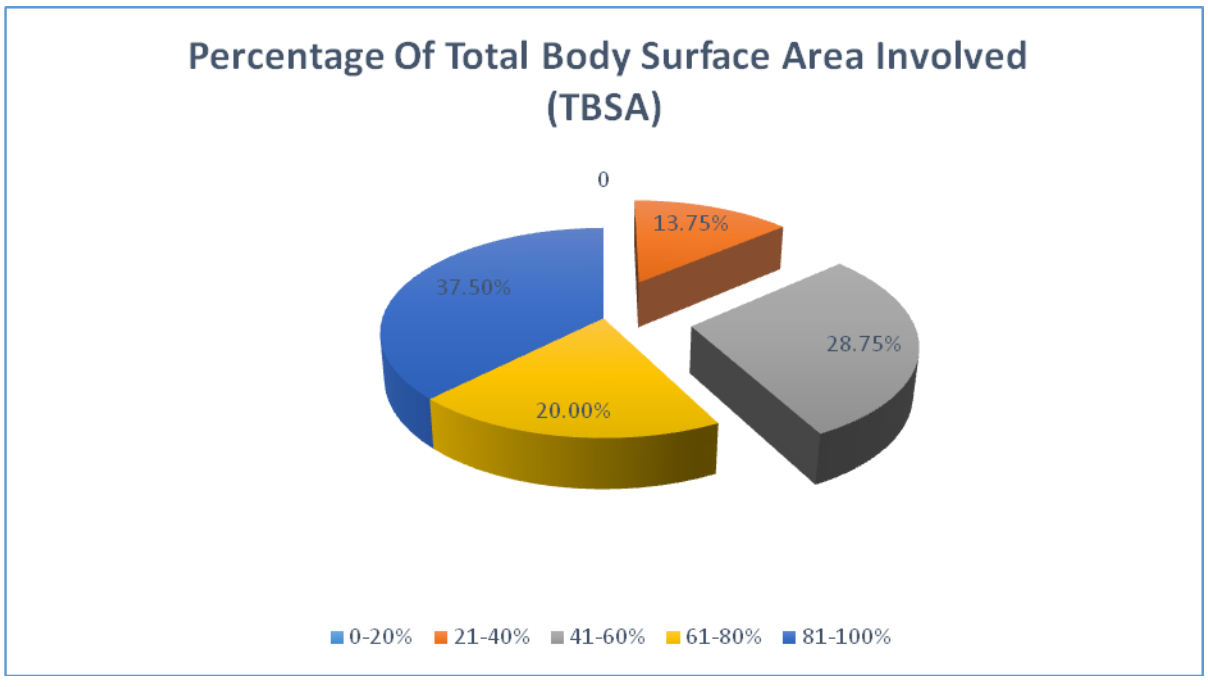


Table-14: Period of Survival - Distribution

	No. of cases	%
< 6HOURS	7	8.75
6-12HOURS	16	20
12-24 HOURS	11	13.75
2-3 DAYS	18	22.5
4-7 DAYS	13	16.25
>1WEEK	15	18.75

The above table shows that 8.75%of the victims could not survive for more than 6 hours, whereas 18.75% victims died after 1 week of the incident.

Figure-22: Period of Survival - Distribution

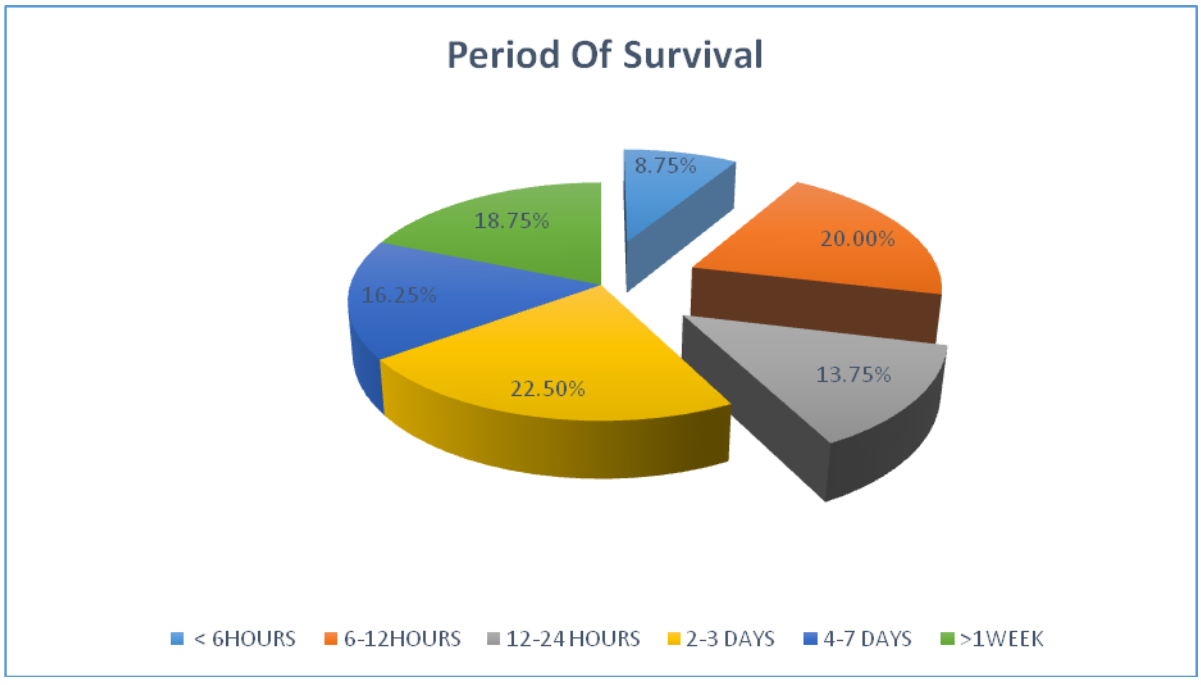


Table-15: Presence of Soot Particles - Distribution

	No. of cases	%
IN AIRWAYS	**15**	**18.75**
IN G.I.T	**1**	**1.25**

Out of 80 cases, presence of soot particles in airway in 18.75% cases and in G.I.T. only in 1.25% cases.

Figure-23: Presence of Soot Particles - Distribution

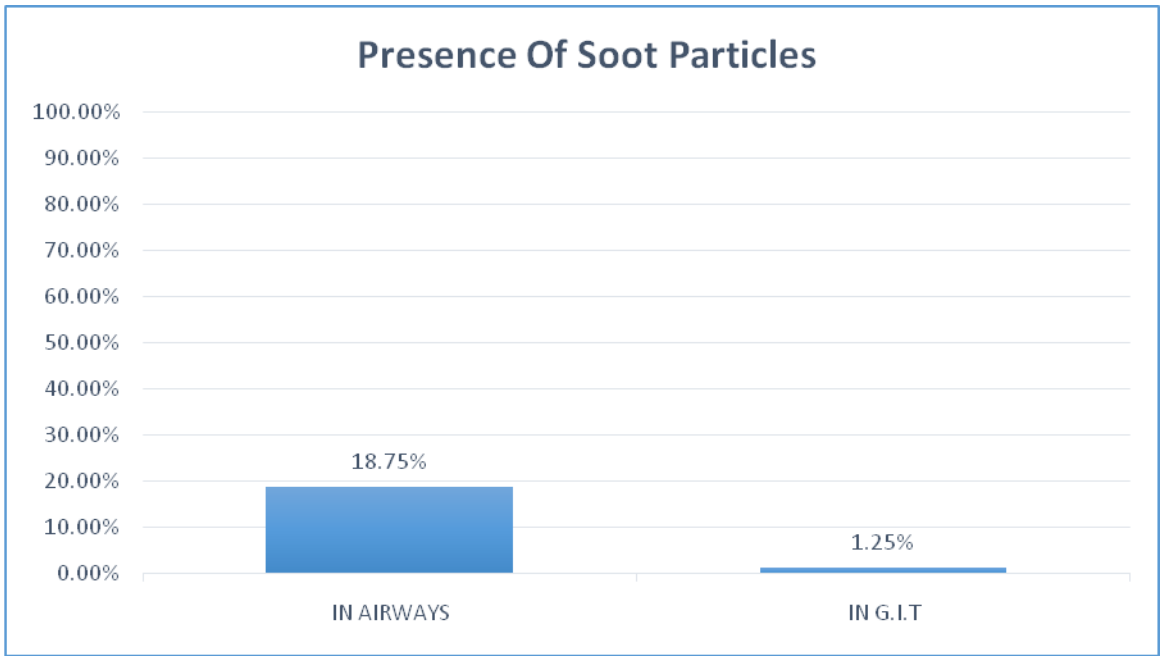


Table-16: HPE: Kidney:

	No. of cases	%
CLOUDY DEGENERATION	**68**	**85**
TUBULAR CAST	**4**	**5**
ACUTE PYELONEPHRITIS	**2**	**2.5**
REGENERATION OF EPITHELIUM	**0**	**0**
ACUTE TUBULAR NECROSIS	**6**	**7.5**

The above table shows cloudy degeneration of kidney in 85% cases and acute tubular necrosis in 7.5%cases.

Figure-24: HPE: Kidney:

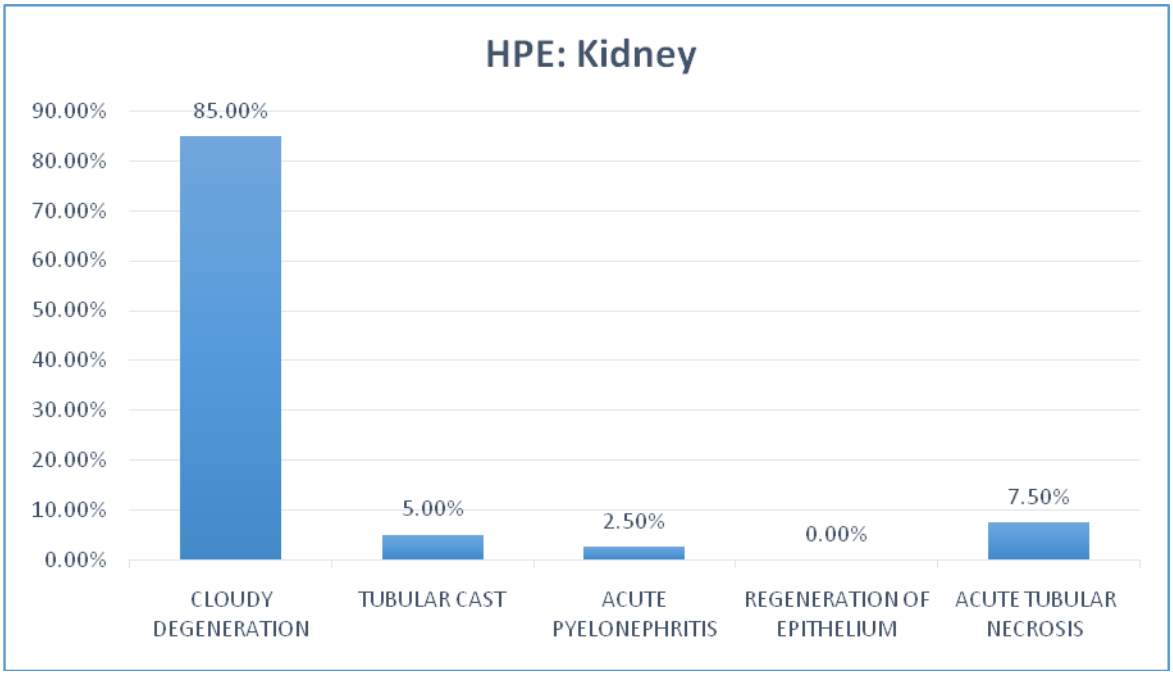
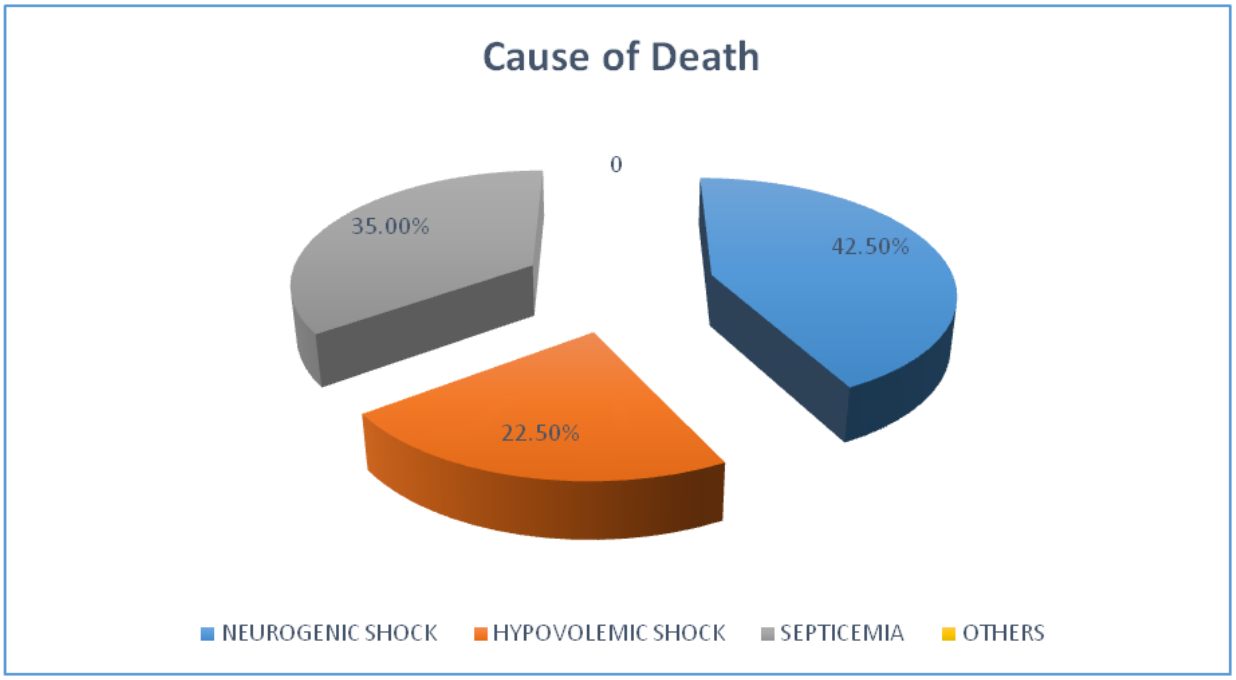


Table-17: Cause of death-Distribution:

	No. of cases	%
NEUROGENIC SHOCK	**34**	**42.5**
HYPOVOLEMIC SHOCK	**18**	**22.5**
SEPTICEMIA	**28**	**35**
OTHERS	**-**	**-**

The above table shows majority of death due to neurogenic shock (42.5%) cases followed by septicemia (35%) and hypovolemic shock (22.5%).

Figure-25: Cause of death-Distribution:



DISCUSSION

AGE: Age wise distribution of death due to burns reveals that maximum number cases are in the age group of 21-30 years and the incidence decrease in the age group of 31 to 40 years followed by 18 -20 years and 41-44 years.

In the studies conducted by Dalbir Singh et al [17] (1998), Mohanty MK et al [26] (2005), Dr. N.P. Zanjad and DR. H.V Godbole [31] (2007), H.M. Mangal et al [32] (2007) Shinde AB Keoliya A.N [41] (2013), Harish D et al [43] (2013), Pandey SK, Chaurasia N [44] (2015) and Dr. Awdhesh Kumar [45] (2015)revealed that burns incident is more common in the age group of 21-30 years which is similar to my study.

RELIGION: Religion wise distribution of death due to burns reveals that maximum cases belongs to Hindu religion in my study.

In the studies conducted by Tripathi CB et al [23](1999) , Arpan Mazumder,Amarjyott Patowary[40] (2013), Harish D et al [43](2013) and Dr. Awdhesh Kumar [45](2015) revealed that burns incident is more common in the Hindu religions which is similar to my study.

OCCUPATION: Occupation wise distribution of death due to burns reveals that maximum cases belongs to housewives in my study.

In the studies conducted by Gupta RK and Srivastava AK [19] (1988), Dalbir Singh et al [17](1998), Jyosthna Devi Ande et al[36] (2011) and Harish D et al [43] (2013)

revealed that burns incident is more common in housewives which is similar to my study.

MARITAL STATUS: Marital status wise distribution of death due to burns reveals that maximum cases belongs to the category of marital age greater than 7 years.This is the sharp contrast to other studies conducted in india where the maximum number of death due to burns in married women is in the first 7 years.

In the studies conducted by Nagesh Kumar Rao [21] (1997) Highest preponderance female burn deaths observed in the age group of 19-25 years (26.7%) i.e., during first 7 years period of marriage which is not similar to my study and in the study conducted by tripathi CB et al [23] (1999) found that almost half (48.68%) of the incidence of death due to burns occurred less than 5 years period of victims marriage which is not similar to my study.

SOCIO-ECONOMIC STATUS: Socio-Economic Status wise distribution of death due to burns reveals that maximum cases belongs to low socio economic status in my study. Unlike in the other studies conducted in india which reveals that the majority of cases belong to middle class women.

In the studies conducted by Vaghela Prithvirajsinh C et al [37] (2012) which is similar to my study whereas the study conducted by Sakhare [29] (1985) and Tahuja [30] (1987) revealed that middle class women had a higher rate of incidence than low socio economic group.

DOMICILIARY: Domiciliary wise distribution of death due to burns reveals that maximum cases belongs to rural area in my study.

In the studies conducted by Tripathi CB et al [23] (1999), Dr.N.P.Zanjad and DR.H.V.Godbole [31] (2007) , Vaghela Prithvirajsinh C et al [37](2012) ,Harish D et al [43](2013) and Dr. Awdhesh Kumar [45](2013) revealed that burns incident is more common in the rural area which is similar to my study.

EDUCATIONAL STATUS: Educational Status wise distribution of death due to burns reveals that maximum cases belongs to primary school followed by illiterate people in my study. In the study conducted by Das gupta and Tripathi [3](1984) reported that59% of burnt wives were illiterate,23%received only primary education and 16% were educated up to secondary standard and only 2% victims were graduate which is not similar to my study.

In the study conducted by Sakhare(1985) [29] in her analysis showed that the major portions of the married burnt females were illiterate. She also found that 76 graduate and post graduate degree holders also in this fray which is not similar to my study.

In the study conducted by Kumar et al[28] (1999) in their study of burnt married females reported the educational background of the victims as illiterate 53.28%,primary 21.71% and junior high and high school 25% which is not similar to my study.

PLACE OF INCIDENT: Place of incident wise distribution of death due to burns reveals that maximum incident occur at home in my study.

In the studies conducted by Vaghela Prithvirajsinh C et al [37] (2012), Mostafa M.Afify et al [38] (2012) and Shinde A.B. Keoliya A.N.[41](2013) revealed that burns incident is more commonly occur at home which is similar to my study.

SEASONAL VARIATION: Seasonal variation vise distribution of death due to burns reveals that maximum incident occurred during winter season followed by summer in my study.

In the studies conducted by Mostafa M.Afify et al [38] (2012) revealed that burns incident is more commonly occurred during winter season followed by summer which is similar to my study. However the study conducted by Pandey SK, Chaurasia N [44] (2014) found that the peak incidence of burns occurred during summer season (43.6%) followed by winter (29.5%) and rainy (26.9%).

TIME OF INCIDENT: Time of incident wise distribution of death due to burns reveals that maximum number of incident occur between 4P.M. to 10 P.M.followed by10 A.M. to 4P.M. in my study.

In the study conducted by Akther J.M.Nerker et al [34](2010) found that the peak incidence of burn occurred between 5A.M to 10A.M (47.4%) followed by between 11P.M to 4A.M (29.8%) which is not similar to my study.

In the study conducted by Mostafa M.Afify et al [38](2012) observed that majority of the burn incidence occur at night time (53.8%) which is not similar to my study.

In the study conducted by Shinde A.B. Keoliya A.N [41](2013) found that the peak incidence of occurrence between 10P.M to 06P.M (46.8%) followed by between 06A.M to 2P.M (26.6%) and between 2P.M to 10P.M (26.6%) which is not similar to my study.

MANNER: Manner wise distribution of death due to burns reveals that revealed that more number of women die of suicidal burns followed by accidental burns in my study.

In the studies conducted by Mostafa M.Afify et al [38] (2012) revealed that manner of burns incident is more commonly by suicidal followed by accidental which is similar to my study. In the study conducted by A.K.Srivastava and P.Arora [33](2007), Dhattarwal SK [18] (1997), Ambade VN et al [27] (2006), Dr.N.P.Zanjad and DR.H.V.Godbole [31](2007), Dr.H.M.Mangal et al [32](2007), Shinde A.B. Keoliya A.N. [41](2013) and Harish D et al [43](2013) found that the majority of deaths were Accidental followed by suicidal and homicidal.

In the study conducted by Dr. Awdhesh Kumar [45](2013) observed that majority of deaths were homicidal (97.24%) followed by Accidental (2.49%).

In the study conducted by Tripathi CB et al [23] (1999) and Tripathi CB et al [24] (2000) observed that majority of the burns victim died of accidentally followed by homicidal and suicide.

In the study conducted by Arpan Mazumder, Amarjyott Patowary [40](2013) observed that, as for the nature of injury, accidental burns topped in list with 229 cases (95%) the rest being suicidal in nature.

TYPE AND SOURCE OF BURNS: Source wise distribution of death due to burns reveals that maximum incident occur by flame burns in my study.

In the studies conducted by Gupta RK and Srivastava AK [19](1988),Dr.N.P.Zanjad and DR.H.V.Godbole [31](2007), Dr.H.M.Mangal et al [32](2007), Dahal P and Paudel BR [35](2010), Mostafa M.Afify et al [38](2012), S.Lal et al [39] (2012) and Harish D et al [43](2013) revealed that burns incident is more common due to flames which is similar to my study.

TOTAL BODY SURFACE AREA INVOLVED: Total Body Surface Area involvement wise distribution of death due to burns in my study revealed that the total body surface area involved was more in greater than 80% category in 37.5 % cases.

In the studies conducted by Mohanty MK et al [26](2005) and Dr.N.P.Zanjad and DR.H.V.Godbole [31](2007) revealed that total body surface involved was greater than 80% category which is similar to my study. However the study conducted by

Dr.H.M.Mangal et al [32](2007) found that the total body surface area involved was more in 40-60% category.

PERIOD OF SURVIVAL: Period of survival vise distribution of death due to burns reveals that majority of death due to burns occurred within one week of the incidence in my study.

In the studies conducted by Dalbir Singh et al [17](1998), Dr.N.P.Zanjad and DR.H.V.Godbole [31](2007) and Mostafa M.Afify et al [38] (2012) revealed that majority of death due to burns occurred within one week which is similar to my study.

SOOT PARTICLES: Presence of soot particles in airways observed in 18.75% cases and 1.25% cases in the gastro intestinal tract in my study.

In the study conducted by Arpan Mazumder, Amarjyott Patowary [40](2013) observed that the soot particles were found in trachea in only 18.5%cases which is similar to my study. However the study conducted by Lerer LB [21](1994) mentioned that 44% had soot in the trachea and main bronchi in homicide associated burns and Mostafa M.Afify et al [38](2012) found that that the soot in airways and or digestive tract in60.4% cases which is not similar to my study.

HISTOPATHOLOGICAL EXAMINATION OF KIDNEY: Histopathological study in kidney showed cloudy degeneration in 85% cases, tubular casts in 5% cases, acute pyelonepritis in 2.5% and acute tubular necrosis in 7.5% cases in my study. In

the study conducted by Shinde A.B. and Keoliya A.N[42] (2013) observed that histopathological in kidneys showed cloudy degeneration in 15.45% cases, tubular casts in 31.81% cases, acute pyelonepritis in 9.09%, regeneration of epithelium in13.63% and acute tubular necrosis in 16.36%cases which is not similar to my study.

CAUSE OF DEATH:

Majority of death due to burns in married women is more due to neurogenic shock (42.5%) followed by septicemia (35%) and hypovolemic shock (22.5%) in my study. In the study conducted by Dr.H.M.Mangal et al [32] (2007) and Mostafa M.Afify et al [38] (2012) found that most of the victims died from neurogenic shock which is similar to my study.

In the study conducted by Dalbir Singh et al [17] (1998), Tripathi CB et al[24] (2000), Jyosthna Devi Ande et al [36] (2011) and S.Lal et al [39](2012) observed that majority of the burn victims died due to Septicemia which is not similar to my study.

CONCLUSION

Accidental burns are mostly preventable by adequate safety measures and safety education. "Bride burning" is a social evil unmatched in its cruelty and cynicism in today's civilized society. Any discussion on its etiopathogenesis and remedial measures must take into account the sociocultural and economic ramifications underlying this scourge. Legal measures however, harsh or deterrent, cannot suffice to combat this scourge due to complete dependence of the woman on her husband and in-laws.

Following measures are recommended:

I) Social and Economic

1. Including safety education in curriculum to prevent domestic accidents.
2. Encouraging all skilled and unskilled workers in industries to adopt safety measures in working place.
3. Public and professionals should be made to realize the magnitude and gravity of the problem.
4. Discouraging dowry demands and offers.

5. Counselling the vulnerable group about positive living.

6. Promoting education among women to make them economically free and independent.

7. Social acceptance and security measures for the single woman who is deserted or left by the dowry seekers.

8. To strive for a social transformation so that both girls and boys choose their life partners.

9. Social boycott of those boys and their families in future marital negotiations by the society.

II) Legal

1. More stringent laws for possession and use of explosive and inflosive and inflammable materials to prevent accidents.

2. Police task force-specially trained in the subject for timely investigation of the case and should provide detailed history and sketched diagram showing arrangements in bedroom and kitchen, with special reference to place of incidence and mode of catching fire.

3. Special legal aid cells for the victims and other relations.

4. Special courts to try the cases expeditiously.

5. Inquest by a magistrate in all cases of young female burn death and strict adherence to existing laws in this regard.
6. Visit to the scene of crime should be made compulsory by autopsy surgeon along with the expert in forensic science with a well-equipped team for proper and prompt investigation with modern techniques.

SUMMARY:

A prospective study of medico legal autopsy conducted in the mortuary of Government Kilpauk Medical College Hospital, Chennai-10, during the period between September 2014 to August 2015.The present study revealed the following:

1) Maximum cases of death due to burns occurred in the age group of 21-30 years (53.75%) and the incidence decrease in the age group of 31 to 40 years followed by 18 -20 years and 41-44 years.

2) Majority of the victims belongs to Hindu religion (83.75%) followed by Muslims (8.75%) and Christians (7.5%).

3) Majority of the victims of fire were house wives (92.5%) and the remaining were labourers (5%) and business/jobs (2.5%) persons.

4)Regarding the marital status, maximum cases belongs to the category of more than 7 years of marriage (67.5%) while others (32.5%) were belongs to less than7 years of marriage.

5) Majority of the victims belongs to low socio economic group (93.75%) followed by middle socio economical groups (6.25%).

6) Majority of the victims were from rural area (58.75%).Remaining were from urban areas (41.25%).

7) Majority of the women who are married educated upto high school (32.5 %) followed primary school education (31.25 %).

8) Majority of burn incidents occur at home (93.75 %).

9) Peak incidence of burns occur at winter season (47.25 %) followed by summer season (38.75 %).

10) Maximum number of incident occur between 4P.M. to 10 P.M (35 %) followed by10 A.M. to 4 P.M. (27.5 %).

11) Manner wise distribution of death due to burns reveals that revealed that more number of women's died of suicidal burns (55 %) followed by accidental burns (42.5 %).

12) All the subjects died as a result of flame burns of these (56.25 %) died due to pouring of kerosene oil.

13) This study revealed that the total body surface area involved was more in > 80% category in 37.5 % cases.

14) Period of survival reveals that majority of death due to burns occurred within 2-3 days of the incidence (22.5 %).

15) Presence of soot particles in airways observed in 18.75% cases and 1.25% cases in the gastro intestinal tract.

16) Histo-pathological study in kidney showed cloudy degeneration in 85% cases, tubular casts in 5% cases, acute pyelo nepritis in 2.5% and acute tubular necrosis in 7.5% cases.

17) Majority of death due to burns in married women is more due to neurogenic shock (42.5%) followed by septicemia (35%) and hypovolemic shock (22.5%).

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ANNEXURE I:

PROFORMA:

1. Subject ID :
2. PM No:
3. Age distribution :

18 – 20 yrs	21 -30 yrs	31- 40 yrs	41-44yrs

4. Religion :

Hindu	Muslims	Christians	Others

5. Occupation :

House wife	Labourer	Business	Job	Student	Others

6. Marital status :

Less than 7 yrs	More than 7 yrs

7. Socio-economic status :

Upper	Middle	Lower

8. Domiciliary :

Urban	Rural

9. Educational status :

Professional 7	
Graduate or Postgraduate 6	
Intermediate/Diploma 5	
High school 4	
Middle school 3	
Primary school 2	
Illiterate 1	

10. Place of incident ;

Home	Working Place	Outside

11. Seasonal variation :

Summer	Rainy	Winter

12. Time of incident :

5am -10 am	10 am- 4pm	4 pm – 10 pm	10 pm – 5 am

13. Manner:

Accidental	Suicidal	Homicidal

14. Type and source of the burn:

Flame burn	1. Kerosene oil pressure stove 2. LPG cylinder 3. Pouring of kerosene oil 4. Indigenous chimney lamp 5. Others
Scald	1. Hot water 2. Vegetable oil 3. Tea/milk
Electric	1. Live wire 2. Short circuit
Chemical	1. Alkali 2. Acid

15. Percentage of Total Body Surface Area involved (TBSA):

0- 20 %	21-40 %	41- 60%	61-80%	➢ 80%

16. Period of survival :

Brought Dead	
Upto 6hrs	
6-12 hours	
12-24 hours	
2-3 Days	
4-7Days	
>1 Week	

17. Presence of soot particles :

Soot in Airways	
Soot in Digestive Tract	

18. HPE: KIDNEY

Cloudy degeneration	
Tubular cast	
Acute pyelonephritis	
Regeneration of epithelium	
Acute tubular necrosis	

19. Cause of death :

Neurogenic Shock	
Hypovolemic Shock	
Septicaemia	
Others	

ANNEXURE – II
ABBREVIATIONS USED IN MASTER CHART

AGE DISTRIBUTION:

18-20	-	18-20 years
21-30	-	21-30 years
31-40	-	31-40 years
41-44	-	41-44 years

RELIGION:

H	-	Hindu
M	-	Muslims
C	-	Christians
O	-	Others

OCCUPATION:

H.W	-	House wife
Labour	-	Labourer
JOB	-	Business/job
ST	-	Student
OT	-	Others

MARITAL STATUS:

< 7 YRS	-	Less than 7 years
> 7 YRS	-	More than 7 years

SOCIO-ECONOMICAL STATUS:

UPPER	-	Upper
MIDDLE	-	Middle
LOW	-	Lower

DOMICILIARY:

URBAN	-	Urban area
RURAL	-	Rural area

EDUCATIONAL STATUS:

PROF	-	Professional 7
GRADUATE/PG	-	Graduate / Post graduate 6
IM / DIPLOMA	-	Intermediate / Diploma 5
HIGH	-	High School 4
MIDDLE	-	Middle School 3
PRIMARY	-	Primary School 2
ILITERATE	-	Illiterate 1

PLACE OF INCIDENT:

HOME	-	Home
W.P	-	Working Place
OUT SIDE	-	Out side

SEASONAL VARIATION:

SUMMER	-	Summer
RAINY	-	Rainy
WINTER	-	Winter

TIME OF INCIDENT:

5AM TO 10 AM	-	5AM - 10 AM
10 AM TO 4 PM	-	10 AM - 4 PM
4PM TO 10 PM	-	4PM - 10 PM
10 PM TO 5 AM	-	10 PM - 5 AM

MANNER OF DEATH:

ACCIDENT	-	Accidental
SUICIDAL	-	Suicidal
HOMICIDAL	-	Homicidal

SOURCE OF BURNS:

KERO.STOV	-	Kerosene oil pressure stove
LPG	-	LPG cylinder
P.K.O	-	Pouring of kerosene oil
CHIMNEY	-	Indigenous chimney lamp
OTHERS	-	Others

% OF TOTAL BODY SURFACE AREA INVOLVED:

0-20 %	-	0 to 20 %
21-40%	-	21 to 40 %
41-60%	-	41 to 60 %
61-80%	-	61 to 80 %
>80%	-	More than 80 %

PERIOD OF SURVIVAL:

BD	-	Brought dead
<6 HRS	-	Up to 6 hours
6-12 HRS	-	6 to 12 hours
12-24 HRS	-	12 to 24 hours
2 – 3 DAYS	-	2 to 3 Days
4 – 7 DAYS	-	4 to 7 Days
> 1WEEK	-	More than 1 week

HPE: KIDNEY

CLOUDY	-	Cloudy degeneration
CAST	-	Tubular cast
PYELO	-	Acute Pyelonephritis
REGEN	-	Regeneration of epithelium
ATN	-	Acute tubular necrosis

CAUSE OF DEATH:

NEURO	-	Neurogenic Shock
HYPO	-	Hypovolemic Shock
SEPTIC	-	Septicemia
OT	-	Others

ANNEXURE – III

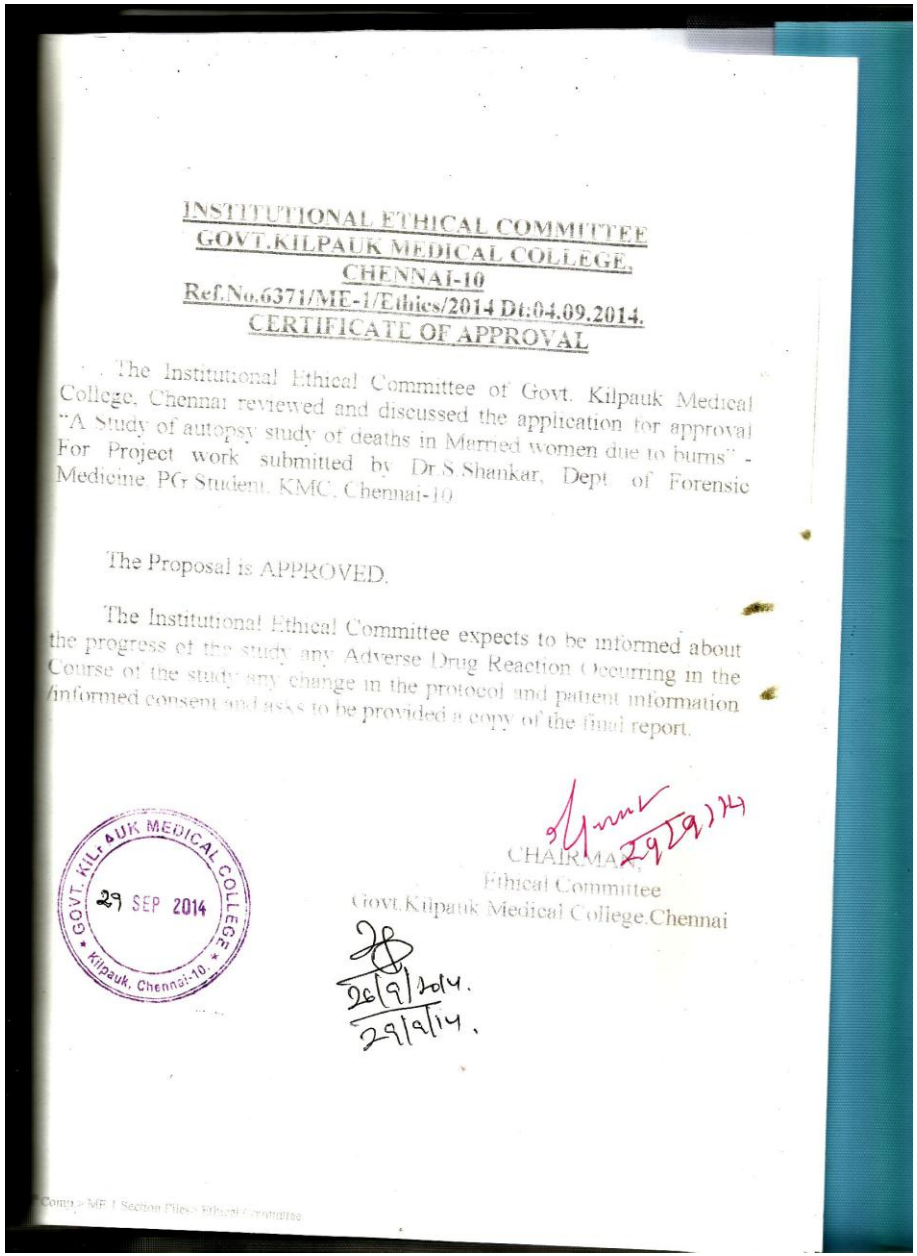
MASTER CHART

Sl. No.	SUBJECT ID	AGE DISTRIBUTION (years)	RELIGION	OCCUPATION	MARITAL STATUS	SOCIO-ECONOMIC STATUS	DOMICILIARY	EDUCATIONAL STATUS:	PLACE	SEASON	TIME	MANNER	SOURCE	TBSA	PERIOD OF SURVIVAL	SOOT PARTICLES IN TRACHEA	SOOT PARTICLES IN G.I.T	HPE: KIDNEY	CAUSE OF DEATH
1	1	31-40	H	H.W	>7YRS	LOW	RURAL	PRIMARY	HOME	WINTER	10AM-4PM	ACCIDENT	KERO.STOV	>80%	6-12HRS	YES	NO	CLOUDY	NEURO
2	2	31-40	C	H.W	>7YRS	LOW	URBAN	ILITERATE	HOME	WINTER	5AM-10 AM	SUCIDAL	P.K.O	>80%	6-12 HRS	NO	NO	CLOUDY	NEURO
3	4	31-40	M	H.W	>7YRS	LOW	RURAL	MIDDLE	HOME	WINTER	10AM-4 PM	SUCIDAL	P.K.O	>80%	12-24HRS	NO	NO	ATN	NEURO
4	5	31-40	H	H.W	>7YRS	LOW	RURAL	ILITERATE	HOME	WINTER	10AM-4PM	SUCIDAL	P.K.O	61-80%	4-7 DAYS	NO	NO	CLOUDY	SEPTIC
5	6	41-44	H	H.W	>7YRS	LOW	URBAN	ILITERATE	HOME	WINTER	10AM-4PM	SUCIDAL	P.K.O	41-60%	2-3 DAYS	NO	NO	CLOUDY	HYPO
6	7	21-30	H	H.W	>7YRS	LOW	URBAN	ILITERATE	HOME	WINTER	4PM-10 PM	ACCIDENT	LPG	61-80%	2-3 DAYS	NO	NO	ATN	HYPO
7	8	31-40	H	H.W	>7YRS	LOW	URBAN	ILITERATE	HOME	WINTER	10 AM -4PM	ACCIDENT	KERO.STOV	41-60%	4-7 DAYS	YES	NO	CLOUDY	SEPTIC
8	9	21-30	H	H.W	>7YRS	LOW	RURAL	ILITERATE	HOME	WINTER	4PM-10 PM	ACCIDENT	CHIMNEY	61-80%	6-12 HRS	NO	NO	CLOUDY	NEURO
9	10	21-30	H	H.W	>7YRS	LOW	URBAN	ILITERATE	HOME	WINTER	4PM-10 PM	SUCIDAL	P.K.O	41-60%	6-12 HRS	YES	NO	CLOUDY	NEURO
10	11	21-30	H	H.W	>7YRS	LOW	RURAL	ILITERATE	HOME	WINTER	4PM-10 PM	SUCIDAL	P.K.O	>80%	2-3 DAYS	NO	NO	CLOUDY	HYPO
11	12	21-30	H	H.W	<7YRS	LOW	URBAN	ILITERATE	OUTSIDE	WINTER	5AM-10 AM	ACCIDENT	OTHERS	21-40%	>1 WEEK	NO	NO	CLOUDY	SEPTIC
12	13	21-30	C	H.W	>7YRS	LOW	URBAN	ILITERATE	HOME	WINTER	4PM-10 PM	ACCIDENT	KERO.STOV	41-60%	>1 WEEK	NO	NO	CLOUDY	SEPTIC
13	14	31-40	H	H.W	<7YRS	LOW	RURAL	PRIMARY	HOME	WINTER	10PM-5AM	SUCIDAL	P.K.O	>80%	2-3 DAYS	NO	YES	CLOUDY	HYPO
14	15	31-40	H	H.W	>7YRS	LOW	RURAL	ILITERATE	HOME	WINTER	5AM-10 AM	SUCIDAL	P.K.O	61-80%	12-24 HRS	NO	NO	CLOUDY	NEURO
15	16	21-30	H	H.W	>7YRS	LOW	URBAN	PRIMARY	HOME	WINTER	4PM-10 PM	ACCIDENT	KERO.STOV	21-40%	>1 WEEEK	NO	NO	CLOUDY	SEPTIC
16	17	31-40	H	H.W	>7YRS	MIDDLE	RURAL	GRADU	HOME	WINTER	4PM-10 PM	ACCIDENT	KERO.STOV	>80%	2-3 DAYS	NO	NO	CLOUDY	HYPO
17	18	21-30	H	H.W	<7YRS	LOW	RURAL	HIGH	HOME	WINTER	4PM-10 PM	ACCIDENT	KERO.STOV	41-60%	>1 WEEK	NO	NO	CLOUDY	SEPTIC
18	19	41-44	H	H.W	>7YRS	LOW	RURAL	HIGH	HOME	WINTER	5AM-10 AM	SUCIDAL	P.K.O	61-80%	12-24 HRS	NO	NO	CLOUDY	NEURO
19	20	21-30	H	H.W	>7YRS	LOW	RURAL	PRIMARY	OUTSIDE	WINTER	4PM-10 PM	HOMICIDAL	P.K.O	41-60%	2-3 DAYS	NO	NO	CLOUDY	HYPO
20	21	21-30	H	H.W	>7YRS	LOW	RURAL	HIGH	HOME	WINTER	4PM-10 PM	SUCIDAL	P.K.O	21-40%	4-7 DAYS	NO	NO	CLOUDY	SEPTIC

Sl. No.	SUBJECT ID	AGE DISTRIBUTION (years)	RELIGION	OCCUPATION	MARITAL STATUS	SOCIO-ECONOMIC STATUS	DOMICILIARY	EDUCATIONAL STATUS:	PLACE	SEASON	TIME	MANNER	SOURCE	TBSA	PERIOD OF SURVIVAL	SOOT PARTICLES IN TRACHEA	SOOT PARTICLES IN G.I.T	HPE: KIDNEY	CAUSE OF DEATH
21	22	21-30	M	H.W	>7YRS	LOW	URBAN	HIGH	HOME	WINTER	4PM-10 PM	ACCIDENT	KERO.STOV	41-60%	>1WEEK	NO	NO	ATN	SEPTIC
22	23	31-40	H	H.W	>7YRS	LOW	RURAL	ILITERATE	HOME	WINTER	5AM-10 AM	ACCIDENT	KERO.STOV	41-60%	4-7DAYS	NO	NO	ATN	SEPTIC
23	24	21-30	H	H.W	<7YRS	LOW	RURAL	HIGH	OUTSIDE	WINTER	10PM-5AM	ACCIDENT	OTHERS	41-60%	2-3DAYS	NO	NO	ATN	HYPO
24	25	31-40	H	H.W	<7YRS	LOW	RURAL	MIDDLE	HOME	WINTER	4PM-10 PM	SUCIDAL	P.K.O	>80%	<6HRS	NO	NO	ATN	NEURO
25	26	31-40	H	H.W	>7YRS	LOW	URBAN	HIGH	HOME	WINTER	10PM-5AM	SUCIDAL	OTHERS	21-40%	>1WEEK	NO	NO	CLOUDY	SEPTIC
26	27	31-40	H	H.W	>7YRS	LOW	URBAN	MIDDLE	HOME	WINTER	10AM-4PM	SUCIDAL	P.K.O	21-40%	2-3 DAYS	NO	NO	PYELO	HYPO
27	28	21-30	H	H.W	>7YRS	LOW	RURAL	HIGH	HOME	WINTER	10 AM -4PM	ACCIDENT	KERO.STOV	41-60%	4-7 DAYS	NO	NO	CLOUDY	SEPTIC
28	29	21-30	H	H.W	<7YRS	LOW	RURAL	PRIMARY	HOME	WINTER	4PM-10 PM	SUCIDAL	P.K.O	21-40%	>1WEEK	NO	NO	CLOUDY	SEPTIC
29	30	21-30	H	H.W	<7YRS	LOW	RURAL	PRIMARY	OUTSIDE	WINTER	4PM-10 PM	ACCIDENT	KERO.STOV	>80%	2-3DAYS	YES	NO	CLOUDY	HYPO
30	31	31-40	H	H.W	>7YRS	LOW	RURAL	HIGH	HOME	WINTER	5AM-10 AM	SUCIDAL	P.K.O	>80%	2-3 DAYS	NO	NO	CLOUDY	HYPO
31	32	21-30	H	H.W	<7YRS	LOW	RURAL	ILITERATE	HOME	WINTER	10PM-5AM	SUCIDAL	P.K.O	>80%	<6HRS	NO	NO	CLOUDY	NEURO
32	33	21-30	H	H.W	<7YRS	LOW	RURAL	HIGH	HOME	WINTER	4PM-10 PM	SUCIDAL	P.K.O	>80%	12-24HRS	NO	NO	CLOUDY	NEURO
33	34	21-30	H	JOB	>7YRS	MIDDLE	RURAL	DIPLOMA	HOME	WINTER	5AM-10 AM	ACCIDENT	KERO.STOV	61-80%	2-3 DAYS	NO	NO	PYELO	HYPO
34	35	31-40	H	H.W	>7YRS	LOW	RURAL	MIDDLE	HOME	WINTER	10AM-4PM	ACCIDENT	KERO.STOV	61-80%	12-24 HRS	YES	NO	CLOUDY	NEURO
35	36	21-30	H	LAB OUR	<7YRS	LOW	RURAL	HIGH	HOME	WINTER	4PM-10 PM	ACCIDENT	KERO.STOV	41-60%	4-7DAYS	NO	NO	CLOUDY	SEPTIC
36	37	21-30	M	H.W	>7YRS	LOW	URBAN	HIGH	HOME	WINTER	5AM-10 AM	ACCIDENT	KERO.STOV	>80%	12-24HRS	NO	NO	CLOUDY	NEURO
37	38	31-40	H	H.W	>7YRS	LOW	RURAL	HIGH	HOME	WINTER	10PM-5AM	SUCIDAL	P.K.O	41-60%	>1 WEEK	NO	NO	CLOUDY	SEPTIC
38	39	21-30	H	H.W	<7YRS	LOW	RURAL	PRIMARY	HOME	SUMMER	4PM-10 PM	SUCIDAL	P.K.O	61-80%	2-3DAYS	YES	NO	CLOUDY	HYPO
39	40	21-30	H	H.W	<7YRS	LOW	RURAL	ILITERATE	HOME	SUMMER	10AM-4PM	ACCIDENT	KERO.STOV	21-40%	2-3 DAYS	NO	NO	CLOUDY	HYPO
40	41	21-30	H	H.W	<7YRS	LOW	URBAN	HIGH	HOME	SUMMER	10AM-4PM	SUCIDAL	P.K.O	61-80%	>1WEEK	NO	NO	CLOUDY	SEPTIC

Sl. No.	SUBJECT ID	AGE DISTRIBUTION (years)	RELIGION	OCCUPATION	MARITAL STATUS	SOCIO-ECONOMIC STATUS	DOMICILIARY	EDUCATIONAL STATUS:	PLACE	SEASON	TIME	MANNER	SOURCE	TBSA	PERIOD OF SURVIVAL	SOOT PARTICLES IN TRACHEA	SOOT PARTICLES IN G.I.T	HPE: KIDNEY	CAUSE OF DEATH
41	42	31-40	M	H.W	>7YRS	LOW	URBAN	ILITERATE	HOME	SUMMER	10PM-5AM	SUCIDAL	P.K.O	>80%	06-12HRS	NO	NO	CLOUDY	NEURO
42	43	18-20	H	LAB OUR	<7YRS	LOW	URBAN	HIGH	HOME	SUMMER	4PM-10 PM	SUCIDAL	P.K.O	>80%	6-12 HRS	NO	NO	CLOUDY	NEURO
43	44	31-40	H	H.W	>7YRS	LOW	URBAN	PRIMARY	HOME	SUMMER	4PM-10 PM	SUCIDAL	P.K.O	61-80%	12-24HRS	NO	NO	CLOUDY	NEURO
44	45	21-30	M	H.W	>7YRS	LOW	RURAL	PRIMARY	HOME	SUMMER	4PM-10 PM	ACCIDENT	OTHERS	61-80%	4-7 DAYS	NO	NO	CAST	SEPTIC
45	46	31-40	H	H.W	>7YRS	LOW	RURAL	PRIMARY	HOME	SUMMER	4PM-10 PM	ACCIDENT	LPG	41-60%	>1WEEK	NO	NO	CLOUDY	SEPTIC
46	47	31-40	H	H.W	>7YRS	LOW	URBAN	PRIMARY	HOME	SUMMER	5AM-10 AM	SUCIDAL	P.K.O	>80%	6-12HRS	YES	NO	CLOUDY	NEURO
47	48	31-40	H	H.W	>7YRS	LOW	RURAL	HIGH	HOME	SUMMER	4PM-10 PM	HOMICIDAL	OTHERS	21-40%	>1WEEK	NO	NO	CLOUDY	SEPTIC
48	49	31-40	H	LAB OUR	>7YRS	LOW	RURAL	PRIMARY	HOME	SUMMER	10PM-5AM	SUCIDAL	P.K.O	41-60%	4-7DAYS	NO	NO	CLOUDY	SEPTIC
49	50	21-30	H	H.W	>7YRS	LOW	RURAL	HIGH	HOME	SUMMER	10PM-5AM	SUCIDAL	P.K.O	>80%	6-12 HRS	NO	NO	CLOUDY	NEURO
50	51	18-20	C	H.W	<7YRS	LOW	URBAN	HIGH	HOME	SUMMER	10AM-4PM	SUCIDAL	P.K.O	>80%	6-12HRS	NO	NO	CLOUDY	NEURO
51	52	21-30	H	H.W	<7YRS	LOW	RURAL	PRIMARY	HOME	SUMMER	10AM-4PM	SUCIDAL	P.K.O	>80%	6-12HRS	NO	NO	CLOUDY	NEURO
52	53	31-40	M	LAB OUR	>7YRS	LOW	URBAN	PRIMARY	HOME	SUMMER	10AM-4PM	SUCIDAL	P.K.O	>80%	6-12HRS	NO	NO	CLOUDY	NEURO
53	54	31-40	H	H.W	>7YRS	LOW	URBAN	HIGH	HOME	SUMMER	10PM-5AM	SUCIDAL	P.K.O	>80%	6-12HRS	NO	NO	CLOUDY	NEURO
54	55	21-30	H	H.W	>7YRS	LOW	RURAL	PRIMARY	HOME	SUMMER	5AM-10 AM	ACCIDENT	KERO.STOV	41-60%	2-3DAYS	NO	NO	CLOUDY	HYPO
55	56	21-30	H	H.W	>7YRS	LOW	URBAN	HIGH	HOME	SUMMER	10PM-5AM	SUCIDAL	P.K.O	>80%	<6HRS	YES	NO	CLOUDY	NEURO
56	57	31-40	H	H.W	>7YRS	LOW	URBAN	MIDDLE	HOME	SUMMER	10PM-5AM	SUCIDAL	P.K.O	41-60%	2-3 DAYS	YES	NO	CLOUDY	HYPO
57	58	21-30	H	H.W	<7YRS	MIDDLE	URBAN	GRADUAT E	HOME	SUMMER	10PM-5AM	ACCIDENT	OTHERS	>80%	6-12HRS	YES	NO	CLOUDY	NEURO
58	59	41-44	H	H.W	>7YRS	LOW	URBAN	PRIMARY	HOME	SUMMER	4PM-10 PM	ACCIDENT	KERO.STOV	41-60%	2-3DAYS	YES	NO	CLOUDY	HYPO
59	60	21-30	H	H.W	>7YRS	LOW	URBAN	MIDDLE	HOME	SUMMER	10PM-5AM	SUCIDAL	P.K.O	21-40%	<6HRS	YES	NO	CLOUDY	NEURO
60	61	31-40	C	H.W	>7YRS	LOW	URBAN	PRIMARY	HOME	SUMMER	10PM-5AM	ACCIDENT	KERO.STOV	41-60%	2-3DAYS	YES	NO	CLOUDY	HYPO

Sl. No.	SUBJECT ID	AGE DISTRIBUTION (years)	RELIGION	OCCUPATION	MARITAL STATUS	SOCIO-ECONOMIC STATUS	DOMICILIARY	EDUCATIONAL STATUS:	PLACE	SEASON	TIME	MANNER	SOURCE	TBSA	PERIOD OF SURVIVAL	SOOT PARTICLES IN TRACHEA	SOOT PARTICLES IN G.I.T	HPE: KIDNEY	CAUSE OF DEATH
61	62	21-30	H	H.W	>7YRS	LOW	URBAN	PRIMARY	HOME	SUMMER	5AM-10 AM	SUCIDAL	P.K.O	>80%	<6HRS	NO	NO	CAST	NEURO
62	63	31-40	H	H.W	>7YRS	LOW	URBAN	PRIMARY	HOME	SUMMER	4PM-10 PM	SUCIDAL	P.K.O	21-40%	4-7DAYS	NO	NO	CLOUDY	SEPTIC
63	64	21-30	M	H.W	>7YRS	LOW	RURAL	ILITERATE	HOME	SUMMER	10PM-5AM	SUCIDAL	P.K.O	>80%	12-24HRS	NO	NO	CLOUDY	NEURO
64	65	31-40	H	H.W	<7YRS	LOW	RURAL	PRIMARY	HOME	SUMMER	10AM-4PM	ACCIDENT	KERO.STOV	41-60%	>1WEEK	NO	NO	CLOUDY	SEPTIC
65	66	21-30	H	H.W	>7YRS	LOW	RURAL	PRIMARY	HOME	SUMMER	4PM-10 PM	ACCIDENT	KERO.STOV	41-60%	4-7DAYS	NO	NO	CAST	SEPTIC
66	67	31-40	H	H.W	>7YRS	LOW	URBAN	PRIMARY	HOME	SUMMER	5AM-10 AM	SUCIDAL	P.K.O	>80%	<6HRS	NO	NO	CLOUDY	NEURO
67	68	21-30	H	H.W	<7YRS	LOW	RURAL	PRIMARY	OUTSIDE	SUMMER	10 AM -4PM	SUCIDAL	P.K.O	61-80%	>1WEEK	NO	NO	CLOUDY	SEPTIC
68	69	21-30	H	H.W	<7YRS	LOW	URBAN	PRIMARY	HOME	SUMMER	4PM-10 PM	SUCIDAL	P.K.O	>80%	<6HRS	YES	NO	CLOUDY	NEURO
69	70	21-30	H	H.W	<7YRS	LOW	RURAL	PRIMARY	HOME	RAINY	10AM-4PM	ACCIDENT	CHIMNEY	21-40%	>1WEEK	NO	NO	CLOUDY	SEPTIC
70	71	21-30	H	H.W	<7YRS	LOW	RURAL	HIGH	HOME	RAINY	5AM-10 AM	ACCIDENT	KERO.STOV	>80%	12-24HRS	NO	NO	CLOUDY	NEURO
71	72	21-30	H	JOB	>7YRS	MIDDLE	URBAN	GRADUAT E	HOME	RAINY	4PM-10 PM	ACCIDENT	LPG	41-60%	4-7DAYS	NO	NO	CLOUDY	SEPTIC
72	73	21-30	H	H.W	>7YRS	LOW	RURAL	HIGH	HOME	RAINY	10AM-4PM	ACCIDENT	KERO.STOV	41-60%	6-12HRS	NO	NO	CLOUDY	NEURO
73	74	21-30	H	H.W	<7YRS	LOW	RURAL	HIGH	HOME	RAINY	10AM-4PM	SUCIDAL	P.K.O	61-80%	2-3 DAYS	NO	NO	CAST	HYPO
74	75	21-30	C	H.W	<7YRS	LOW	URBAN	PRIMARY	HOME	RAINY	10PM-5AM	SUCIDAL	P.K.O	61-80%	6-12HRS	YES	NO	CLOUDY	NEURO
75	76	31-40	H	H.W	>7YRS	LOW	RURAL	HIGH	HOME	RAINY	10AM-4PM	SUCIDAL	P.K.O	>80%	12-24HRS	NO	NO	CLOUDY	NEURO
76	77	31-40	H	H.W	>7YRS	LOW	RURAL	HIGH	HOME	RAINY	10AM-4PM	ACCIDENT	KERO.STOV	61-80%	>1WEEK	NO	NO	CLOUDY	SEPTIC
77	78	21-30	H	H.W	>7YRS	LOW	RURAL	PRIMARY	HOME	RAINY	4PM-10 PM	SUCIDAL	P.K.O	>80%	6-12HRS	YES	NO	CLOUDY	NEURO
78	79	31-40	H	H.W	>7YRS	LOW	RURAL	MIDDLE	HOME	RAINY	10AM-4PM	ACCIDENT	KERO.STOV	61-80%	4-7DAYS	NO	NO	CLOUDY	SEPTIC
79	80	18-20	H	H.W	<7YRS	LOW	RURAL	MIDDLE	HOME	RAINY	5AM-10 AM	SUCIDAL	P.K.O	>80%	12-24HRS	NO	NO	CLOUDY	NEURO
80	81	21-30	C	H.W	<7YRS	MIDDLE	URBAN	DIPLOMA	HOME	RAINY	10AM-4PM	SUCIDAL	P.K.O	41-60%	4-7 DAYS	NO	NO	CLOUDY	SEPTIC



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GOVT.KILPAUK MEDICAL COLLEGE,
CHENNAI-10
Ref.No.6371/ME-1/Ethics/2014 Dt:04.09.2014.
CERTIFICATE OF APPROVAL

. . The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval "A Study of autopsy study of deaths in Married women due to burns" - For Project work submitted by Dr.S.Shankar, Dept of Forensic Medicine PG Student, KMC, Chennai-10.

The Proposal is APPROVED.

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

GOVT. KILPAUK MEDICAL COLLEGE
29 SEP 2014
Kilpauk, Chennai-10.

29/9/14

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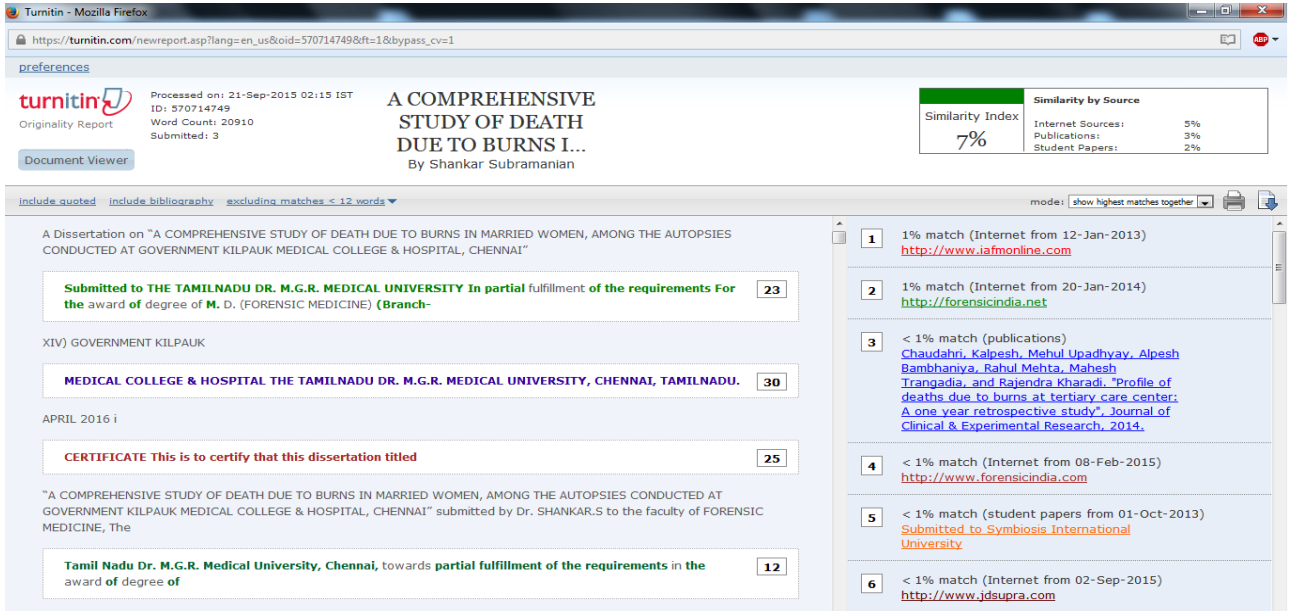
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Submitted to THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY In partial fulfillment of the requirements For the award of degree of M. D. (FORENSIC MEDICINE) (Branch- 23

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